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PACIFIC GAS AND ELECTRIC COMPANY

2018 NUCLEAR DECOMMISSIONING COST TRIENNIAL PROCEEDING

PREPARED TESTIMONY
ATTACHMENTS SUPPORTING CHAPTER 4

VOLUME 3

PACIFIC GAS AND ELECTRIC COMPANY
2018 NUCLEAR DECOMMISSIONING COST TRIENNIAL PROCEEDING
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CHAPTER 4

ATTACHMENT A

DIABLO CANYON POWER PLANT DETAILED COST ESTIMATE

DECOMMISSIONING COST ESTIMATE

DIABLO CANYON POWER PLANT

12/13/2018
Pacific Gas and Electric

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ACRONYMS AND ABBREVIATIONS

3D	Three-Dimensional
A/C	Air Conditioning
AA	Access Authorization
ACM	Asbestos-Containing Material
ADA	American with Disabilities Act
ADAMS	Agencywide Documents Access and Management System
ALARA	As Low As Reasonably Achievable
ALJ	Administrative Law Judge
ASW	Auxiliary Saltwater
ATC	Authority to Construct
AWS	Abrasive Wire Saw
BBP	Bulk Building Preparation
BBRE	Blast and Bullet Resistant Enclosure
Bldg.	Building
BOL	Bill of Lading
BLM	Bureau of Land Management
BPRA	Burnable Poison Rod Assemblies
BWR	Boiling Water Reactor
C&D	Cold and Dark
CalOSHA	California Division of Occupational Safety and Health Administration
CalTrans	California Department of Transportation
CARB	California Air Resources Board
CAS	Central Alarm Station
CCC	California Coastal Commission
CCW	Component Cooling Water
CDFW	California Department of Fish and Wildlife
CDP	Coastal Development Permit
CDPH	California Department of Public Health
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEQA	California Environmental Quality Act
CHP	California Highway Patrol
CFH	Certified Fuel Handler
CFR	Code of Federal Regulations
CISCC	Chloride Induced Stress Corrosion Cracking
CISF	Consolidated Interim Storage Facility
CMTR	Certified Material Test Report

CPUC	California Public Utilities Commission
CRDM	Control Rod Drive Mechanisms
CRGT	Control Rod Guide Tube
CSLC	California State Lands Commission
CST	Condensate Storage Tank
CTF	Cask Transfer Facility
Cu.	Cubic
CVCS	Chemical Volume and Control System
CZMA	Coastal Zone Management Act
DAW	Dry Active Waste
DBT	Design Basis Threat
DC	Diablo Canyon
DC/RMS	Document Control/Records Management System
DCDEP	Diablo Canyon Decommissioning Engagement Panel
DCE	Decommissioning Cost Estimate
DCGL	Derived Concentration Guideline Level
DCPP	Diablo Canyon Power Plant
DF	Decontamination Factor
DG	Demolition Group
DHCS	Department of Health Care Services
DHS	Department of Health Services
DOE	U.S. Department of Energy
DOD	U.S. Department of Defense
DOT	U.S. Department of Transportation
DPR	Decommissioning Project Report
DQO	Data Quality Objectives
DRPI	Digital Rod Position Indicators
DSAR	Defueled Safety Analysis Report
DTSC	Department Toxic Substances Control
EDG	Emergency Diesel Generator
EFPY	Effective Full Power Years
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EO	Executive Order
EOF	Emergency Operations Facility
EP	Emergency Preparedness
EPA	U.S. Environmental Protection Agency
EPC	Engineering, Procurement, and Construction

ERO	Emergency Response Organization
ESA	Endangered Species Act
EWS	Early Warning System
FEMA	Federal Emergency Management Agency
FFD	Fitness For Duty
FHB	Fuel Handling Building
FHBVS	Fuel Handling Building Ventilation System
FIN	Fix-It-Now
FMCSA	Federal Motor Carrier Safety Administration
FOSAR	Foreign Object Search And Retrieval
FSR	Final Site Restoration
FSS	Final Status Survey
ft.	Feet
ft^3	Cubic Feet
FTE	Full-Time Equivalent
FY	Fiscal Year
GAO	U.S. Government Accountability Office
GEIS	General Environmental Impact Statement
GET	General Employee Training
gpd	Gallons Per Day
GPI	Groundwater Protection Initiative
gpm	Gallons Per Minute
GTCC	Greater Than Class C
GWd	Gigawatt-Days
GWTS	Ground Water Treatment System
HB	Humboldt Bay
HBPP	Humboldt Bay Power Plant
HEPA	High-Efficiency Particulate Air
HMBP	Hazardous Materials Business Plan
HMSP	Hazardous Materials Safety Permit
HP	High Pressure
HPGe	High Purity Germanium
HR	Human Resources
hr(s)	Hour(s)
HSA	Historical Site Assessment
HVAC	Heating, Ventilation, and Cooling

I&C	Instrumentation and Controls
IAEA	International Atomic Energy Agency
IBC	Internal Barrel Cutter
IGP	Industrial Stormwater General Permit
IH	Industrial Hygiene
IHA	Integrated Head Assembly
IM/RAW	Interim Measures Remedial Action Work
IP	Industrial Package
ISFSI	Independent Spent Fuel Storage Installation
ISOCS	In-Situ Object Counting Systems
IT	Information Technology
ITP	Incidental Take Permit
JIC	Joint Information Center
JRP	Joint Review Panel
kV	Kilovolt
LAR	License Amendment Request
LARW	Low-Activity Radioactive Waste
LBD	Licensing Basis Document
lbs.	Pounds
LCP	Local Coastal Program
LCR	Large Component Removal
LDCC	Low-Density Cellular Concrete
LLRW	Low-Level Radioactive Waste
LP	Low Pressure
LPT	Low-Profile Transporter
LRW	Liquid Radioactive Waste
LTP	License Termination Plan
LUP	Land Use Permit
M	Million
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MCA	Multichannel Analyzers
MDS	Modular Detritiation System
MID	Moveable Incore Drive
MMG	Materials Management Group
MOU	Memorandum of Understanding
MPC	Multi-Purpose Canister

mR / mrem	Millirem
MSL	Mean Sea Level
MSR	Moisture Separator Re-Heaters
MTU	Metric Ton of Uranium
MVA	Mega Volt Amp
Mwe	Megawatt Electrical
NCO	Non-Certified Operators
NDCTP	Nuclear Decommissioning Cost Triennial Proceeding
NDT	Nuclear Decommissioning Trust
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFWC	Non-Fuel Waste Container
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NSSS	Nuclear Steam Supply System
NWPA	Nuclear Waste Policy Act
OAD	Open Air Demolition
OCA	Owner-Controlled Area
ODCM	Offsite Dose Calculation Manual
OE	Operating Experience
OSGSF	Old Steam Generator Storage Facility
OSHA	Occupational Safety and Health Administration
OTC	Once-Through Cooling
P&ID	Piping and Instrumentation Diagram
PA	Protected Area
PACM	Presumed Asbestos-Containing Material
PAF	Personnel Access Facility
PAPR	Powered Air Purifying Respirator
pcb	Polychlorinated Biphenyl
PCM	Personal Contamination Monitor
PEP	Project Execution Plan
PERP	Portable Equipment Registration Program
PG&E	Pacific Gas & Electric Company
PIDS	Perimeter Intrusion Detection System

PIV	Post Indicator Valve
PMP	Project Management Plan
PPE	Personal Protective Equipment
PPP	Pre-Project Plan
PRC	Public Resources Code
PRDP	Preliminary Radiological Decommissioning Plan
PSDAR	Post Shutdown Decommissioning Activities Report
PSLHD	Port San Luis Harbor District
psig	Pounds Per Square Inch Gauge
PSS	Primary Segmentation Station
PTO	Permit-To-Operate
PWR	Pressurized Water Reactor
PZR	Pressurizer
QA	Quality Assurance
RAI	Request for Additional Information
RAM	Radioactive Material
RCA	Radiological Controls Area
RCS	Reactor Coolant System
RCRA	Resource Conservation and Recovery Act
RCP	Reactor Coolant Pump
REMP	Radiological Environmental Monitoring Program
RFP	Request for Proposal
RHR	Residual Heat Removal
RMS	Records Management System
RP	Radiation Protection
rpm	Revolutions Per Minute
RPV	Reactor Pressure Vessel
RSB	Radwaste Storage Building
RVI	Reactor Vessel Internals
RWQCB	Regional Water Quality Control Board
RWST	Refueling Water Storage Tank
Rx	Reactor
SAC	System and Area Closure
SACP	System and Area Closure Plan
SAFSTOR	Safe Storage
SAM	Small Article Monitor
SAS	Secondary Alarm Station

SB	Senate Bill
SCE	Southern California Edison
SCS	Site Characterization Study
SFM	Spent Fuel Management
SFP	Spent Fuel Pool
SFPI	Spent Fuel Pool Island
SG	Steam Generators
SGI	Safeguards Information
SHPO	State Historic Preservation Officer
SIP	Site Infrastructure Plan
SLO	San Luis Obispo
SLOAPCD	San Luis Obispo County Air Pollution Control District
SME	Subject Matter Expert
SNF	Spent Nuclear Fuel
SNM	Special Nuclear Material
SONGS	San Onofre Nuclear Generating Station
SPCC	Spill Prevention Countermeasure and Control
SPMT	Special Purpose Multi-Wheel Transporter
SRSF	Solid Radwaste Storage Facility
SSC	Structures, Systems, and Components
STS	Special Tactical Services
SWPPP	Storm Water Pollution Prevention Plan
SWRO	Sea Water Reverse Osmosis
T-comm / TCOM	Telecommunications
TG	Transportation Group
TLD	Temporary Lifting Device or Thermoluminescent Dosimeter
TPH	Total Petroleum Hydrocarbons
TN	TransNuclear
TS	Technical Specifications
TSC	Technical Support Center
TSDF	Treatment Storage and Disposal Facilities
U1	Unit 1
U2	Unit 2
UBC	Uniform Building Code
UDN	Utility Data Network
UPRR	Union Pacific Rail Road
UPS	Uninterruptable Power Supply
USACE	U.S. Army Corps of Engineers

USC	U.S. Code
USEI	U.S. Ecology Idaho
V	Volt
VCT	Vertical Cask Transporter
VLLW	Very Low-Level Waste
WCS	Waste Control Specialists
WDR	Waste Discharge Requirements
WHAT	Waste Holding and Treatment
WMF	Waste Management Facility
WOG	Waste Operations Group
Zirc	Zirconium

1 - EXECUTIVE SUMMARY

In January 2018, Pacific Gas and Electric Co. (PG&E) received approval from the California Public Utilities Commission (CPUC or Commission) to shut down its two nuclear reactors at Diablo Canyon Power Plant (DCPP) when its operating licenses expire in 2024 and 2025. PG&E prepared this site-specific Decommissioning Cost Estimate (DCE) to identify the cost and schedule to complete radiological decommissioning of DCPP Units 1 and 2; termination of the DCPP 10 Code of Federal Regulations (CFR) Part 50 (Part 50) licenses; management of spent fuel until the Department of Energy (DOE) has completed removal of Spent Nuclear Fuel (SNF) and Greater Than Class C (GTCC) waste; termination of the Diablo Canyon (DC) Independent Spent Fuel Storage Installation (ISFSI) 10 CFR Part 72 (Part 72) license; and site restoration activities.

The DCE assumes immediate decommissioning upon plant shutdown with the removal of contaminated and activated plant components and structural materials, and that decommissioning will be accomplished within the 60-year period required by current Nuclear Regulatory Commission (NRC) regulations. The DCE also assumes that spent fuel remains in storage at the site under the site-specific 10 CFR 72 license until such time that the transfer to a licensed offsite storage facility can be completed. Once the spent fuel transfer is complete, the onsite ISFSI will be decommissioned, and the final 10 CFR 72 NRC license terminated.

The DCE was developed from the ground up without reference to the unit cost factor methodology used in prior DCPP Nuclear Decommissioning Cost Triennial Proceedings (NDCTPs). This DCE is based on cost-based and historical bid-based estimating, direct experience gained by PG&E after 10 years of full-scale decommissioning at Humboldt Bay Power Plant (HBPP) Unit 3, industry expertise, and benchmarking.

The cost estimation methodology utilized in prior NDCTPs was prepared by PG&E's consultant, TLG, following the basic approach originally presented in the "Guidelines for Producing Commercial Nuclear Power Decommissioning Cost Estimates," (T.S. LaGuardia et al., AIF/NESP-036, May 1986). It was developed using unit factors for concrete removal, steel removal, and cutting costs based on local labor rates. The activity-dependent costs were then estimated with the item quantities (cubic yards and tons). As previously recognized by the Commission, that methodology is intended only to provide an estimate for financial planning purposes; it does not represent an actual decommissioning plan. Thus, this DCE represents a fundamentally different form of cost estimation, is not directly comparable to prior estimates, and as a site-specific decommissioning cost estimate provides a more accurate representation of the actual expected cost of decommissioning.[1]

The projected total cost to decommission DCPP, including costs spent to date, is approximately $4.80 billion (2017$) as shown in Table 1-1. All costs in this DCE are in 2017$ unless otherwise noted. Except

[1] PG&E has based this DCE on a physical decommissioning plan. However, while the cost estimate will be relevant for comparison purposes, it can be expected that as decommissioning approaches, PG&E will make changes and

for costs estimated for pre-shutdown planning activities described in Section 4.1.1.1.1, all costs include a contingency factor as stipulated in Table 3-17.

Table 1-1: Projected Total Cost to Decommission DCPP

ID	Scope Description	Total (in thousands)
1	Program Management, Oversight, & Fees	$1,462,045
2	Security Operations	$560,686
3	Waste/Transportation/Material Management (Excluding Breakwater, RPV/RVI, and LCR)	$855,211
4	Power Block Modifications	$80,707
5	Site Infrastructure	$140,972
6	Large Component Removal	$166,370
7	Reactor/Internals Segmentation	$332,341
8	Spent Fuel Transfer to ISFSI	$235,541
9	Turbine Building	$68,667
10	Aux Building	$92,122
11	Containment	$121,012
12	Fuel Handling Building	$48,627
14	Balance of Site	$80,702
15	Intake	$41,654
16	Discharge	$15,122
17	Breakwater	$286,326
18	Non-ISFSI Site Restoration	$135,075
19	Spent Fuel Transfer to DOE	$24,258
20	ISFSI Demolition and Site Restoration	$54,956
	Grand Total	**$4,802,395**

Table 1-2 provides a breakdown of the DCE by decommissioning phase (as set forth in Section 4.1) and Unit.

Table 1-2: Projected Total Cost to Decommission DCPP by Decommissioning Phase and Unit

Decommissioning Phase	Unit 1	Unit 2	Grand Total
	(in thousands)		
License Termination	$1,465,834	$1,462,531	$2,928,365
Spent Fuel Management	$600,752	$571,839	$1,172,592
Site Restoration	$190,308	$511,130	$701,438
Grand Total	**$2,256,894**	**$2,545,501**	**$4,802,395**

improvements, and this DCE does not represent a commitment to perform decommissioning work exactly as presented in the DCE.

1.1. OBJECTIVE

The objective of this DCE is to provide a new, comprehensive evaluation of the activities, costs, and schedule to decommission DCPP. Development and submittal of the DCE complies with the Commission's requirement to file an updated DCE every three years and meets PG&E's commitment in the Commission-approved Joint Proposal to present a site-specific DCE for DCPP in the 2018 NDCTP. The DCE includes costs related to complying with Commission orders in the decision approving the Joint Proposal, D.18-01-022, and subsequently modified by the State Legislature in Senate Bill (SB) 1090 on Aug. 20, 2018 and signed into law by Gov. Jerry Brown on Sept. 19, 2018.

1.2. PLANT DESCRIPTION

The two-unit DCPP consists of a pair of Westinghouse 4 loop pressurized water reactors. At full capacity, Unit 1 and Unit 2 each has a thermal rating of 3411 MWt, with corresponding gross electrical outputs of 1190 MWe. The units went on line in 1984 and 1985, respectively; so far, they have been running at about 87 percent of capacity.

The site where the plant and the ISFSI are located was initially developed by PG&E in the late 1960s. Attachment A, Site History of DCPP Units 1 and 2, provides a photographic history of the site beginning in the 1960s. The plant is located on the central California coast in San Luis Obispo County, approximately 12 miles west southwest of the city of San Luis Obispo, 7.5 miles north of Avila Beach and 7 miles south of Montaña De Oro State Park. The plant is roughly equidistant between San Francisco and Los Angeles.

Normal vehicle access to DCPP is along a non-banked, flat paved road from a gate in Avila Beach. Alternative routes are available on dirt roads from both the north and south.

The power plant is roughly centered on 12,500 acres owned and controlled by PG&E and Eureka Energy Company; 750 of those acres are inside the site boundary, where the plant, intake, and spent fuel nuclear storage areas are operated under stringent security controls. PG&E controls all activities within the site boundary, and to the mean highwater line along the ocean. No public road or railroad crosses the site. Figure 1-1 shows DCPP in relationship to the site boundary (10 CFR 50 license boundary). Figure 1-2 shows the building locations within the site boundary.

All coastal properties north of Diablo Creek extending to the southern boundary of Montaña de Oro State Park and inland a distance of 0.5 to 1.75 miles have been owned by PG&E since 1988. All coastal properties south of Diablo Creek to Port San Luis and inland approximately 1.75 miles were purchased by Eureka Energy Company in 1995 and leased back to PG&E. Except for the DCPP site boundary, all the acreage north and south of DCPP is encumbered by two grazing leases.

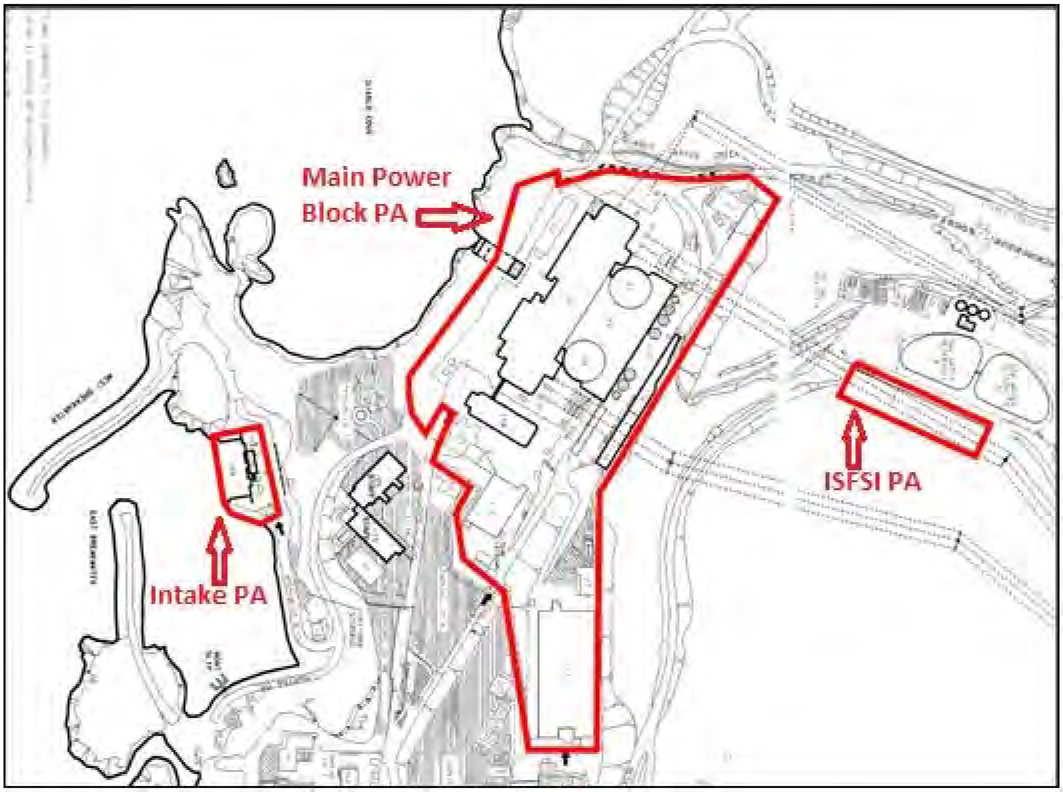
Figure 1-1: 10 CFR 50 License Boundary

The site boundary is the area in which security controls are established.

There are three protected area (PA) locations within the site boundary as shown in Figure 1-2. The three PAs consist of the main power block PA, intake PA, and ISFSI PA. Within these areas, DCPP maintains a physical protection system and security organization to protect identified target locations against radiological sabotage, prevent the theft or diversion of special nuclear material and provide adequate protection of public health and safety from any security event described in the Site Emergency Plan. See Section 3.4 for a discussion on security.

Following permanent shutdown of DCPP Units 1 and 2 and transfer of all spent fuel to ISFSI, only the ISFSI PA will remain. The main power block PA, which currently protects against the release of any highly radioactive material, will transition to an industrial security area after the highly radioactive material is removed. The intake PA is also expected to be downgraded after both units enter decommissioning.

Figure 1-2: DCPP Protected Area Locations



When the DCPP site was selected for a new nuclear plant, it was used for farming and ranching. Both are still conducted on the land outside of the site boundary.

The plant site extends from the Pacific Ocean east a few hundred yards, climbing to nearly 1,000' (feet) above sea level. The Discharge Structure, Intake Structure, Intake Cove and Breakwater are at sea level. Most of the power block and administrative buildings, shops and warehouses are on a bluff top bench between 85’ and 140’ above sea level. The electrical switchyards, reservoir ponds and the ISFSI are located east of the power block in a small canyon about 300’ above sea level; other structures are located further east above the switchyards. The DCPP site facilities and improvements encompass approximately 200 acres of the DCPP property. The rugged nature of the property restricts the availability of staging areas, temporary structure space and parking.

There are three PAs within the site boundary, as shown in Figure 1-2. These are the main power block, intake areas, and the DC ISFSI. Within these areas, PG&E maintains a physical protection system and security personnel that are required by the NRC to protect identified target locations against radiological sabotage, to prevent the theft or diversion of special nuclear material and to provide adequate protection of public health and safety from any security event described in the Site Emergency Plan. (See Section 3.4 for a discussion on Security).

After DCPP Units 1 and 2 are permanently shutdown and all SNF/SNM requiring an NRC security plan have been transferred to the ISFSI, only the ISFSI PA will have the NRC-required level of security. The main power block PA, which currently protects against the release of any highlight radioactive material, will transition to an industrial security area after the highly radioactive material is removed. The intake PA is expected to be similarly downgraded after both units enter decommissioning.

All areas within the site boundary are subject to remediation, and some restoration work is expected to extend beyond the site boundary. The DCE assumes the site will be maintained in its current condition and configuration through the end of the current operating licenses with limited facility changes between now and plant shutdown.

1.3. COMMISSION APPROVAL OF AGREEMENT TO RETIRE DIABLO CANYON AT THE END OF CURRENT OPERATING LICENSES

In 2016, PG&E entered into an agreement referred to as the Joint Proposal (See Reference 1.1). In the Joint Proposal, PG&E agreed to withdraw the pending application at the NRC to renew the operating licenses for DCPP Units 1 and 2 for an additional 20 years and instead retire DCPP when the current operating leases expire. PG&E also agreed to submit to the Commission a site-specific decommissioning cost estimate for DCPP in the 2018 NDCTP, including costs for maintaining certain facets of emergency preparedness through license termination. In addition to these commitments, all of the parties to the Joint Proposal agreed to: (1) procurement of three tranches of greenhouse gas-free resources to partially replace the output of DCPP; (2) retention, retraining, and severance programs for DCPP employees; (3) a program that would provide funding to the local community to mitigate the economic impact of the plant’s retirement; and (4) rate recovery of various costs, including amounts spent for environmental reviews and PG&E’s then-suspended NRC license renewal application. PG&E requested Commission approval of the Joint Proposal in an application filed in August 2016, A.16-08-006.

In January 2018, the Commission issued a decision approving certain elements of the Joint Proposal (Reference 1.2). Among other things, the Commission approved PG&E’s proposal to retire DCPP upon the expiration of the current operating licenses and commitment to file a site-specific DCE for DCPP in the 2018 NDCTP. The Commission also directed PG&E to establish and implement a public stakeholder process before taking any action regarding the disposition of DCPP facilities and surrounding lands.[2]

1.4. NRC LICENSE TERMINATION

1.4.1. License Termination Plan

There are three NRC-issued licenses governing DCPP operations: two issued under 10 CFR 50 pertaining to operation of each DCPP reactor unit and a third issued under 10 CFR 72 pertaining to the storage of spent nuclear fuel and operation of the ISFSI.

[2] D. 18-01-022, OP 13.

Once radiological decommissioning is complete, PG&E will petition the NRC to terminate the 10 CFR 50 licenses. At least two years prior to the anticipated date of license termination, PG&E must submit a License Termination Plan (LTP). Submitted as an appendix to the Defueled Safety Analysis Report (DSAR), the LTP must include a site characterization; description of the remaining dismantling activities; plans for site remediation; procedures for the final radiation survey; designation of the end use of the site; an updated cost estimate to complete the decommissioning; and any associated environmental concerns. The NRC will notice its receipt of the LTP in the Federal Register, make it available for public comment and schedule a local hearing. LTP approval will be subject to any conditions and limitations deemed appropriate by the NRC.

Incorporated into the LTP is the Final Survey Plan. This plan identifies the radiological surveys to be performed once the decontamination activities are completed and is developed using the guidance provided in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). This document incorporates the statistical approaches to survey design and data interpretation used by the Environmental Protection Agency (EPA). It also identifies state-of-the-art, commercially available instrumentation and procedures for conducting radiological surveys. Use of this guidance ensures that the radiological surveys are conducted in a manner that provides a high degree of confidence that applicable NRC criterial are satisfied. Once the survey is complete, the results will be provided to the NRC in a format that can be verified. The NRC will review and evaluate the information, perform an independent confirmation of radiological site conditions, and make a final determination regarding termination of the licenses.

The NRC will terminate the 10 CFR 50 licenses when it determines that site remediation has been performed in accordance with the LTP and that the final radiation surveys and associated documentation demonstrate that the facility is suitable for release.

The DC ISFSI operations do not depend on continuation of the DCPP Part 50 license. However, the DC ISFSI Part 72 site-specific license currently includes some provisions that have an impact on the partial release of DCPP Part 50 facilities and areas. The DC ISFSI Part 72 site-specific license currently uses the same site boundary, owner-controlled area (OCA), and Emergency Plan as the Part 50 licenses. The Part 72 site-specific license will require changes to programs and plans, such as the security plan, emergency plan, environmental monitoring program, and ODCM to support a stand-alone ISFSI – one that is no longer sharing a site with a nuclear power plant.

A Preliminary Radiological Decommissioning Plan (PRDP) will be prepared and submitted to the NRC for termination of the ISFSI Part 72 site-specific license after the SNF and GTCC waste has been removed from the site. The NRC will terminate the Part 72 site-specific license when it determines that: ISFSI site remediation has been performed in accordance with the PRDP and the final radiation surveys and associated documentation demonstrate that the ISFSI is suitable for release.

1.4.2. Radiological Criteria for License Termination

In 1997, the NRC published 10 CFR 20 Subpart E, Radiological Criteria for License Termination, amending 10 CFR 20. This subpart provides radiological criteria for releasing a site for unrestricted use. The regulation states that the site can be released for unrestricted use if radioactivity levels are such that the average member of a critical group would not receive a Total Effective Dose Equivalent in excess of 25 millrems (mrem) per year and provided that residual radioactivity has been reduced to levels that are As Low as Reasonably Achievable (ALARA), the guiding principle of radiation safety.

The NRC and the U.S. Environmental Protection Agency (EPA) differ on the amount of residual radioactivity considered acceptable in site remediation. The EPA has two limits that apply to radioactive materials. An EPA limit of 15 mrem per year is derived from criteria established by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or Superfund). An additional limit of 4 mrem per year, as defined in 40 CFR 141.16, is applied to sources of water that could make their way into drinking water.

On October 9, 2002, the NRC signed a Memorandum of Understanding (MOU) with the EPA on the radiological decommissioning and decontamination of NRC-licensed sites. The MOU provides that the EPA will defer exercise of authority under CERCLA for the majority of facilities decommissioned under NRC authority. The MOU includes provisions for NRC and EPA consultation for certain sites when, at the time of license termination, (1) groundwater contamination exceeds EPA-permitted levels; (2) NRC contemplates restricted release of the site; and/or (3) residual radioactive soil concentrations exceed levels defined in the MOU. The MOU does not impose any new requirements on NRC licensees and should reduce the involvement of the EPA with NRC licensees that are decommissioning. Most sites are expected to meet the NRC criteria for unrestricted use. For any site areas that do not meet the NRC criteria for unrestricted use, the EPA may be involved in the cleanup. As such, the possibility of dual regulation remains for certain licensees. The DCE does not include any costs associated with consultation with EPA or any EPA-delegated agencies.

1.4.3. Decommissioning Strategies

The NRC provided general decommissioning requirements in a rule adopted on June 27, 1988. In this rule, the NRC defined three acceptable decommissioning strategies: DECON, SAFSTOR, and ENTOMB. In all options, the decommissioning process must be completed within 60 years of final plant shutdown. An extension to the 60-year term requires NRC approval and is considered only when it can be shown that the longer duration is necessary to protect public health and safety. The three strategies are:

DECON is defined as "a method of decommissioning, in which structures, systems, and components that contain radioactive contamination are removed from a site and safely disposed at a commercially operated low-level waste disposal facility or are decontaminated to a level that permits the site to be released for unrestricted use shortly after it ceases operation.” (Reference 1.3) This alternative is also known as “immediate dismantling”.

SAFSTOR is defined as "a method of decommissioning in which a nuclear facility is placed and maintained in a condition that allows the facility to be safely stored and subsequently decontaminated (deferred decontamination) to levels that permit release for unrestricted use." (Reference 1.4) This alternative is also known as “deferred dismantling”.

ENTOMB is defined as "a method of decommissioning, in which radioactive contaminants are encased in a structurally long-lived material, such as concrete. The entombed structure is maintained, and surveillance is continued until the entombed radioactive waste decays to a level permitting termination of the license and unrestricted release of the property." (Reference 1.5)

Consistent with Commission and stakeholder preferences, the DCE assumes a direct transition from operational to DECON status. (See Section 1.5 below.)

1.5. DECISION TO DIRECTLY TRANSITION FROM OPERATIONAL TO DECON STATUS

The DCE reflects PG&E’s plan to transition to immediate DECON after final unit shutdown in 2024 and 2025. This scenario assumes decommissioning activities at the two units begin soon after unit shutdown and are sequenced and integrated to minimize the total cost and duration of the physical dismantling processes. This subsection discusses the decision to use this approach.

In the Joint Proposal Application (A.) 16-08-006 and PG&E’s 2015 NDCTP (A.)16-03-006, the Commission and stakeholders expressed a strong preference for prompt decommissioning (DECON) upon permanent plant shutdown. In PG&E’s 2015 NDCTP, the Commission stated “PG&E has provided implicit indications that it will commence decommissioning work as soon as the facilities are shut down. If this presumption changes, PG&E will bear the burden to demonstrate why SAFSTOR as opposed to DECON is in the public interest.”[3]

Not only is transition to immediate DECON consistent with Commission and stakeholder preference, it is in the best interest of PG&E’s customers because the total cost of decommissioning can be reduced by direct transition to decommissioning immediately upon plant shutdown. PG&E determined that immediate transition to decommissioning is more cost-effective than the SAFSTOR option based on the following considerations: (1) the operating licenses are terminated earlier; (2) earlier security staff and emergency plan reductions; (3) benchmarking experience of other plants supports more efficient resolution of technical challenges; and (4) availability of experienced, in-house staff.

Typically, initial planning efforts detailing the decommissioning process can take 18 to 24 months after reactor shutdown before physical decommissioning begins. To support a direct transition to immediate DECON, PG&E plans to leverage the Commission’s early approval of DCPP shutdown in 2024 and 2025 to

[3] D.17-05-020, at pp. 68-69.

continue decommissioning planning and permitting activities from 2019 to 2024. The planning would streamline the decommissioning effort, reduce decommissioning costs, and accelerate the schedule by allowing physical decommissioning to begin shortly after permanent shut down. This also would significantly shorten the overall decommissioning schedule. Industry experience indicates that early, detailed preparation and planning reduces the duration and cost of decommissioning while enhancing safety and efficiency (References 1.6 and 1.7).

In summary, it is clear to PG&E that direct transition to DECON is the best path forward, and the Commission and other stakeholders have agreed. The only way to implement this direct transition is to complete significant decommissioning planning work prior to shut down. (See Section 4.1.1.1.1)

1.6. COMPARISON TO PRIOR ESTIMATES

In response to the Commission's directive, Table 1-3 identifies the cost estimates filed and approved in the 2012 and 2015 NDCTPs to enable comparison to the 2018 site-specific DCE. Because the unit factor cost categorizations in the 2012 and 2015 NDCTPs are different than those in the 2018 DCE, costs from the 2012 and 2015 NDCTPs have been allocated into categories consistent with the 2018 DCE to the greatest extent possible.

The current estimate is an increase from the estimate prepared by TLG Services, Inc. and presented in the 2015 NDCTP of $3.8 billion (2014$), $4.1 billion (2017$), and the amount approved of $2.51 billion (2014$), $2.71 billion (2017$).

Table 1-3: Comparison of 2012, 2015, and 2018 NDCTP DCPP Cost Estimates

		2012 NDCTP		2015 NDCTP		2018 NDCTP
		A	B	C	D	E
		Base 2012 NDCTP (2017$)	Approved 2012 NDCTP (2017$)	Base 2015 NDCTP (2017$)	Approved 2015 NDCTP (2017$)	Base 2018 NDCTP (2017$)
ID	Scope Description	(in thousands)				
1	Staffing and Administrative	$976,691	$866,017	$1,210,156	$836,038	$1,462,045
2	Security Operations	$684,365	$406,887	$748,516	$218,574	$560,686
3	Waste/Transportation/Material Management (Excluding Breakwater, RPV/RVI Segmentation, and Large Component Removal)	$286,847	$244,821	$371,944	$314,761	$855,211
4	Power Block Modifications	$66,994	$67,892	$59,174	$57,861	$80,707
5	Site Infrastructure	$11,365	$11,518	$19,158	$11,534	$140,972
6	Large Component Removal	$162,727	$125,380	$181,640	$178,861	$166,370
7	Reactor/Internals Segmentation	$181,766	$126,442	$276,862	$190,933	$332,341

		2012 NDCTP		2015 NDCTP		2018 NDCTP
		A	B	C	D	E
		Base 2012 NDCTP (2017$)	Approved 2012 NDCTP (2017$)	Base 2015 NDCTP (2017$)	Approved 2015 NDCTP (2017$)	Base 2018 NDCTP (2017$)
ID	Scope Description	(in thousands)				
8	Spent Fuel Transfer to ISFSI	$213,162	$213,249	$236,855	$287,098	$235,541
9	Turbine Building	$28,103	$28,480	$28,141	$28,737	$68,667
10	Aux Building	$63,214	$64,062	$67,171	$64,669	$92,122
11	Containment	$204,418	$192,258	$198,340	$193,228	$121,012
12	Fuel Handling Building	$27,201	$27,566	$24,008	$23,632	$48,627
14	Balance of Site	$30,914	$31,329	$33,325	$31,593	$80,702
15	Intake	$10,354	$10,493	$10,504	$10,523	$41,654
16	Discharge	$1,460	$1,480	$1,495	$1,483	$15,122
17	Breakwaters	$72,818	$73,794	$376,809	$74,019	$286,326
18	Non-ISFSI Site Restoration	$112,851	$60,888	$120,248	$83,737	$135,075
19	Spent Fuel Transfer to DOE	$128,645	$130,370	$107,309	$104,928	$24,258
20	ISFSI Demolition and Site Restoration	$5,216	$5,277	$9,734	$417	$54,956
	GRAND TOTAL	**$3,269,112**	**$2,688,201**	**$4,081,388**	**$2,712,625**	**$4,802,395**

1.7. MAJOR ASSUMPTIONS UNDERLYING COST ESTIMATE

As discussed in greater detail in Chapters 2 -, 3 -, and 4, the following are major elements affecting decommissioning costs:

- *Regulatory Approvals and Permits:* PG&E will require many regulatory approvals and permits to decommission DCPP. These are critical items and require close coordination with federal, state, and local agencies. Delays in obtaining – or failure to obtain – approval and/or possible regulatory conditions could significantly impact estimated costs. As an example, PG&E's water management plan is based on two assumptions with major financial implications: (1) PG&E will obtain an extension of its California State Lands Commission (CSLC) lease to continue use of the intake cove and discharge structures for drawing in ocean water and discharging waste water to the ocean; and (2) PG&E will obtain a National Pollutant Discharge Elimination System (NPDES) permit to allow for discharges of waste water to the Pacific Ocean during decommissioning. Failure to obtain either of these approvals would result in significant additional costs. (See Section 3.1.)

- *CSLC Lease Requirements:* PG&E has a CSLC lease (PRC No. 9347.1) that requires PG&E to remove the DCPP Intake Structure, Breakwaters and Discharge Structure at the termination of the lease. While PG&E believes that removal of the Intake Structure and Discharge Structure is warranted, PG&E, in consultation with the community and relevant agencies, is evaluating repurposing the Breakwaters. However, until PG&E has obtained final approvals, the cost of complying with the CSLC lease must be included in the estimated cost to decommission DCPP. (See Sections 2.4 and 3.2.)
- *Waste Disposal:* Waste disposal costs are significant costs associated with decommissioning. PG&E's current plan involves taking several proactive steps to minimize the volumes of waste that must be disposed of and to utilize the most cost-effective waste disposal options. See Section 3.3.
- *Security:* Security is an integral component during decommissioning. PG&E has conducted a comprehensive review involving state-of-the-art software and site walk downs of DCPP security requirements pre- and post-unit shutdown. PG&E's post-shutdown security plan has been independently reviewed by a third-party expert consultant. PG&E also has identified several cost mitigation measures, including (1) plant modifications which will reduce the number of necessary security personnel; and (2) affirmative steps which PG&E may take prior to the beginning of each phase of decommissioning to reduce the number of security personnel. (See Section 3.4.)
- *Spent Nuclear Fuel:* Costs associated with SNF are a significant component of the DCE. The DCE is based on assumptions that: (1) PG&E will complete transfer of SNF and GTCC waste from the spent fuel pool (SFP) to the ISFSI seven years after Unit 2 shutdown; and (2) the DOE will begin collecting SNF in the nuclear industry in 2031 and will specifically begin picking up SNF at DCPP in 2038. (See Section 3.5.)
- *Pre-Planning*: PG&E will conduct significant planning for decommissioning prior to the shutdown of Unit 1. This early planning will permit PG&E to begin decommissioning immediately upon shutdown and will result in significant cost savings. (See Section 4.1.1.1.1) shutdown and will result in significant cost savings. (See Section 4.1.1.1.1)

2 - PRELIMINARY DECOMMISSIONING PLANNING AND ACTIVITIES

The purpose of this chapter is to describe the preliminary decommissioning planning and activities and the development of the site-specific DCE. In addition, this section provides an overview of efforts performed by PG&E regarding: (1) Preliminary Site Characterization and Remediation and (2) Consultations with key agencies to satisfy Commission directives. The costs associated with the preliminary decommissioning planning and activities and the development of the DCE are provided in Section 4.1.1.1.1.

2.1. PRELIMINARY PLANNING

In mid-2016, PG&E began a rigorous process to fully understand the options available for decommissioning DCPP. Pre-project planning concluded with the issuance of a Pre-Project Plan (PPP).

PG&E developed the PPP to identify an initial decommissioning planning process, scheduled to occur prior to the shutdown of Unit 1. The PPP is a high-level outline of the necessary planning activities to fully transition from operational to DECON status.

The PPP development team consisted of 12 individuals with more than 100 years combined of experience in decommissioning, including PG&E management who had direct decommissioning experience with HBPP Decommissioning and contracted decommissioning industry subject matter experts (SMEs). The PPP underwent a rigorous review process by both internal and external SMEs along with a critical review by PG&E executive management. The PPP was completed in December 2016 and recommended developing a DCPP site-specific DCE through preparation of Project Management Plans (PMPs) and studies.

2.2. DEVELOPMENT OF THE DCE

Using the PPP as a roadmap, PG&E initiated detailed preparation of critical planning elements over 24 months to develop the site-specific DCE for the 2018 NDCTP. PG&E did not rely on a generic nuclear industry decommissioning unit cost factor methodology, but instead used a dedicated team of nuclear, decommissioning and DCPP experts to form a decommissioning plan, schedule, and associated cost estimate. This “bottom up” approach included the following phases and used targeted industry SMEs and third-party reviews of decisions, plans, assumptions, and cost estimates:

- DCPP decommissioning planning team development and work scope
- Request for Proposal (RFP) process, including modification of the PPP-recommended roadmap to better utilize vendor expertise and current industry practices, and to reduce costs
- Benchmarking
- Preparation of PMPs and studies

2.2.1. DCPP Decommissioning Planning Team Development and Work Scope

The DCPP decommissioning planning team was assembled under the leadership of the Senior Director of Decommissioning, who currently leads the decommissioning activities at HBPP and has experience from numerous other sites throughout the nuclear industry. The planning team includes experts in specific fields who understand the complexity and multi-discipline requirements for a project of this scale. This includes PG&E leadership, decommissioning-experienced personnel, DCPP operating plant departmental personnel, specialty contractors, corporate legal, finance, and accounting. The use of decommissioning experienced personnel during planning is supported by outside agencies and fulfills a CPUC directive in its Decision 07-01-003. This blend of knowledge and experience yielded an effective team to develop the decommissioning plan for DCPP. The DCPP decommissioning planning team focused on:

- Developing the processes needed to control the flow of planning, such as decommissioning programs and administrative procedures
- Identifying those studies and PMPs that could be developed internally and conducting the associated analyses
- Identifying those studies and PMPs to be bid out and awarded externally to experienced vendors with the applicable expertise
- Reviewing and accepting vendor work products to ensure adequacy for inclusion in the DCE

2.2.2. RFP Process

The DCPP decommissioning planning team developed the RFPs for the activities requiring external support or independent evaluation from vendors to obtain the most recent industry experience and techniques. This included identifying and describing the technical scope specifications of activities and cost elements followed by an analysis of each item identified. In the RFPs, PG&E requested that vendor work products contain each scope item described in terms of duration, resource requirements, and cost to complete the work so that it could be used in the DCE.

PG&E invited nearly 70 vendors with knowledge and expertise in nuclear, decommissioning, construction, demolition, environmental and regulatory to participate in the RFP process for awarding decommissioning planning work at a Supplier Orientation in May 2017. The desire was to utilize the most qualified vendors to develop the foundation of a defendable and executable DCE. Initially, as outlined in the PPP, PG&E intended to issue ten separate RFP “bundles” that grouped together PMPs and studies with similar scopes for work. However, after additional PG&E consideration, feedback from vendors that attended the Supplier Orientation, and feedback during the RFP process, PG&E decided to restructure and further consolidate the work scopes into six RFP bundles. Doing so would allow for a single vendor to coordinate the various interfaces and integration of the individual work scopes, reducing the time and effort to develop the PMPs and studies and, as a result, reducing the overall costs for the work. This also enabled PG&E to develop a more integrated and efficient overall decommissioning strategy and implementation plan. The re-structure and re-bundling of work scopes in RFPs was implemented before several contracts were issued, saving PG&E time in negotiations and contract issuance, reducing DCE vendor development costs, and allowing vendors to bid more efficiently. PG&E's decision to re-structure and re-bundle the scopes of work resulted in a cost avoidance of $1.9 million.

Vendors that were ultimately awarded contracts had specialty sub-contractors supporting work product development. In addition to the re-bundled PMPs and studies, PG&E awarded contracts to non-bundle vendors for those PMPs and studies that required limited coordination with other plans.

2.2.3. Benchmarking

In addition to obtaining recent industry experience from vendors through their development of PMPs and studies discussed below, PG&E completed benchmarking with those sites that either completed or are still completing decommissioning. It used a two-tiered approach. First, it conducted an email benchmark survey with the following sites:

- Crystal River (Florida)
- Humboldt Bay (California)
- Kewaunee (Wisconsin)
- Oyster Creek (New Jersey)
- Rancho Seco (California)
- San Onofre Nuclear Generating Station (SONGS) (California)
- Trojan (Oregon)
- Vermont Yankee (Vermont)
- Zion (Illinois)

Based on survey responses, PG&E then determined which sites would provide experience that could be applied at DCPP and visited them to conduct in-person benchmarking. This thoughtful selection of in-person benchmarking was completed so that funds were only expended on those benchmarking trips that would provide useful insights for DCPP. In-person benchmarking took place at the following sites:

- Crystal River
- Oyster Creek
- SONGS
- Vermont Yankee
- Zion

The insights gained from PG&E's industry benchmarking included the areas of staffing, spent fuel management, waste transportation, security, cost control, risk, and community engagement.

In addition, as part of the work scope requirements for developing the various PMPs and studies, vendors included their own benchmarking research and insights.

2.2.4. Project Management Plans and Studies

PMPs and studies were prepared to establish the site-specific baseline for decommissioning activities, costs, and an executable schedule. PMPs were prepared to develop the plans for major decommissioning evolutions, while studies were prepared to gather information on specific topics. This thoughtful analysis allowed PG&E to evaluate options for optimal cost performance. Additional detail of the PMPs and studies are provided below:

2.2.4.1. Project Management Plans

The PMPs established cost estimates for key programs (e.g., waste and transportation), projects (e.g., RPV and internals segmentation, large component removal, and building demolition) and engineering activities (e.g., cold and dark for the power distribution at the site during decommissioning and SFP island (SFPI) for cooling the spent fuel) for the DCE in the 2018 NDCTP application. They serve two purposes – to establish costs for the DCE and to guide the development of bid specifications for specific decommissioning work. They reflect the experience and lessons learned from decommissioning experts.

Two types of PMPs were used:

Programmatic PMPs

These addressed specific subject areas such as staffing and transportation that are required to support decommissioning and defined related tasks. Cost estimates were developed (see Section 4.1) grouped into cost categories and time-phased using the summary project schedule milestones. Programmatic PMPs include:

- Materials Management Plan (externally developed under RFP)
- Permitting Plan (internally developed)
- Spent Fuel Management Plan (externally developed under RFP)
- Staffing Plan (internally developed)
- Transportation Plan (externally developed under RFP)
- Waste Management and Disposal Plan (externally developed under RFP)

Discrete-Scope PMPs

Discrete-scope PMPs provided criteria and methodology on the specified work scopes and associated material removal, area clean-up, required tools and equipment, handling and disposal of debris, equipment, components, and structures. These included sketches and illustrations that depict the extent of the activity. These PMPs provide the basis for bid specifications. Discrete-Scope PMPs include:

- Building Demolition (externally developed under RFP)
- Cold and Dark (externally developed under RFP)
- Decontamination Plan (externally developed under RFP)

- Final Site Restoration (FSR) (externally developed under RFP)
- Future Land Use (externally developed under RFP)
- GTCC Canister Storage (internally developed)
- ISFSI/GTCC Site Restoration Plan Part 72 (externally developed under RFP)
- Large Component Removal (externally developed under RFP)
- License Termination Scope Plan (externally developed under RFP)
- Liquid Radioactive Water Processing (externally developed under RFP)
- Non-Radiological Water Processing (externally developed under RFP)
- Reactor Pressure Vessel (RPV) and Internals Removal and Disposal (externally developed under RFP)
- Site Infrastructure (externally developed under RFP)
- Site Security Modifications for Decommissioning (internally developed)
- Spent Fuel/GTCC Transfer to DOE (externally developed under RFP)
- SFPI (externally developed under RFP)
- Spent Fuel Transfer to ISFSI (externally developed under RFP)
- System and Area Closure Plan (SACP) (externally developed under RFP)

2.2.4.2. Studies

The decommissioning studies addressed specific issues or concerns, such as water management issues, site infrastructure needs, and options for source term reduction. The studies identified options for executing the specified actions, provided specific technical expertise for proper sequencing and provided a more accurate cost estimate of the activities. In many cases, the studies provided input for PMP development or for solely making a decision. Some studies, such as Future Land Use Evaluation, will be used to make financial or strategic decisions. The studies are an integral part of the development of PMPs. In conjunction with the PMPs and studies, PG&E evaluated licensing submittals, permits, procedures, and strategic work packages to help obtain the required regulatory authorizations to begin decommissioning activities as soon as practical after permanent shutdown.

Two types of studies were used – cost studies to provide the basis for cost estimates not addressed in programmatic or discrete PMPs and option assessment studies to gather information and evaluate alternatives.

Cost Studies

During decommissioning, not all costs are distributable to specific projects. Cost studies were performed to fill in those gaps. They list the detailed activities and time-phased cost estimate for each topic addressed. Cost Studies include:

- Specialty Contracts (internally developed)
- Source Term Reduction Study (externally developed under RFP)
- Tools, Equipment, Supplies, and Consumables Study (internally developed)

Option Assessment Studies

Option assessment studies were performed to identify methods to execute the specified tasks. These assessments were used to help develop associated PMPs. Option assessment studies include:

- Decommissioning Contracting Strategy During Field Execution (internally developed)
- GTCC Waste Storage Location Siting Study (internally developed)
- Identification of the Need for Deep Excavations (internally developed)
- Legacy Waste Disposition Assessment (internally developed)
- Open Air Demolition Criteria Assessment (externally developed under RFP)
- RPV Activation and GTCC Waste Study (externally developed under RFP)
- Site Characterization and Asbestos Assessment (externally developed under RFP)
- Site Infrastructure Assessment (internally developed)
- Water Management Study (externally developed under RFP)

2.2.5. DCE

Together, the studies and PMPs were used to develop the executable project schedule, which is part of the DCE. The project schedule provided not only a road map for systematic project execution but also the means by which to gauge progress, identify and resolve potential cost estimate problems, and promote accountability at all levels of the estimate. A schedule provided a time sequence for the duration of a project's activities and aided in understanding the dates for major milestones and the activities that drive the schedule. A project schedule was used as a vehicle for developing a project cost baseline. Among other things, scheduling allows project management to decide between possible sequences of activities, determine the flexibility of the schedule according to available resources, and predict the consequences of action or inaction on events. (See Chapter 5 for a discussion on the decommissioning schedule.)

The cost estimate was developed in phases and consists of both discrete and unassigned costs. Discrete costs are those expenses that are directly attributable to an activity with specific completion criteria such as RPV removal or establishing a SFPI. Unassigned costs are expenses not easily attributed to a discrete work scope such as staffing, waste, and transportation costs.

After each cost was allocated, the costs were grouped into categories (see Section 4.1 for a description of the categories) and time phased using the project schedule.

The DCE uses actual costs for completed decommissioning activities and forecasts costs for planned decommissioning activities. As decommissioning progresses, decisions will be made on contracting strategies; decommissioning strategies and work sequences; selection of decommissioning technologies; and final site end state. Decommissioning cost estimate submittals will be updated and submitted to the Commission and/or NRC to reflect decommissioning decisions and changes as decommissioning approaches.

In summary, the planning efforts described above compiled high-level, executable plans; studies of specific activities anticipated during decommissioning; detailed guidance in the form of PMPs for specific scopes of work; an executable schedule; administrative processes that defined interactions with regulators, stakeholders, and staff; and financial processes for estimating, tracking, and reporting decommissioning costs. In addition, the planning efforts satisfied the Joint Proposal requirement to prepare and submit to the Commission a DCPP site-specific DCE no later than the 2018 NDCTP filing.

2.3. PRELIMINARY SITE CHARACTERIZATION AND REMEDIATION

Site characterization has been conducted to the maximum extent practicable for an operating nuclear power plant site. A Historical Site Assessment (HSA) was performed for the site in 2018. This investigation collected information regarding the site history from the start of operations to the present and used the following sources of information:

- Annual environmental reports
- Annual effluent reports
- Licensee event reports
- 10 CFR 50.75g files
- Groundwater sampling data
- Radiation survey data
- Area and boundary locations for radiological areas
- Corrective action reports
- Personnel interviews

The HSA identified potential non-radiological contamination, such as petroleum hydrocarbons, asbestos, and lead paint, and potential radioactive contamination. Both types warrant additional investigation as part of the site characterization plan to be performed upon plan shutdown.

An example of non-radiological contamination (an area of concern) is residual diesel fuel oil that was discovered under the Unit 1 Turbine Building in 1993 following replacement of the originally installed carbon steel fuel oil tanks which had degraded. The diesel fuel oil contamination is confined to a sand layer under the building's foundation. This contamination is documented in the 10CFR50.75g file, as required by regulation. The contaminated sand layer is confined and stable because it sits on top of an impermeable soil clay layer. The diesel fuel oil contamination cannot be removed at this time as it may compromise the existing building foundation and underlying slopes. PG&E agreed to clean up the residual contamination during decommissioning in a letter of agreement with the county of San Luis Obispo during decommissioning. The replacement diesel fuel oil tanks are of double wall construction and use leak detection monitoring.

An example of a potentially radiologically impacted area is paved and soil surfaces adjacent to the Unit 1 Auxiliary boiler system. Low-level radioactively contaminated water was released to paved surfaces through an improper floor drain alignment when a contaminated tank system was undergoing maintenance in 1993. The material was not removed for a variety of reasons – it was a low-level contamination event, the contamination was embedded in the paved surfaces, and it was not removable. After the paved surfaces were sealed in place, no contamination was detected. This contamination event was documented in the 10 CFR 50.75g file and will be detailed as part of site characterization.

Regulation requires minimizing, preventing, and documenting both radiological and chemical-related contamination and spill events. Robust programs and initiatives are in place to minimize and prevent both. They include:

- The 2006 Nuclear Energy Institute (NEI) groundwater protection initiative (GPI 07-007), which establishes standards for sampling and reporting groundwater monitoring.
- The Buried Piping Program, which analyzes and inspects below-grade piping
- The Radiological and Environmental Monitoring Program (REMP), which monitors for radioactive contamination in the environment.
- The Effluents Control Program administered by the Offsite Dose Calculation Manual (ODCM), which regulates and monitors radioactive effluents.
- The Spill Prevention Countermeasure and Control Program (SPCC), which catalogs and develops procedures and controls to prevent hydrocarbon spills.
- The Storm Water Pollution Prevention Plan (SWPPP), which controls site exposure to rainfall and potential pollutants.

As a result of these initiatives, all feasible efforts are being made to prevent chemical or radiological contamination that could harm humans and/or the environment. If a significant spill occurs, the event is immediately documented in the corrective action program. If a spill cannot be completely cleaned up or mitigated, the event will be documented as required by 10 CFR 50.75g. Any government regulatory agency may require interim or complete cleanup of a spill or contamination event if the event could harm humans or the environment.

It is not practicable or cost effective for DCPP to aggressively remove residual contamination, both radiological and non-radiological, prior to permanent shutdown. Nor is it possible to accurately undertake detailed physical sampling and characterization of residual contamination before then. This is because physical characterization of the site could be compromised in accuracy if a radiological or non-radiological event occurred while the units were still operating. If the accuracy of site characterization was questioned due to early sampling, then additional costs would be incurred for additional surveys and sampling for both radiological and non-radiological contaminants.

2.4. STATUS OF AGENCY CONSULTATIONS

This section provides PG&E's response to the Commission's direction in the 2015 NDCTP decision that PG&E provide "a summary and results of consultation with the California Coastal Commission, State Lands Commission, Department of Public Health, California State Water Resources Control Board, and the Department of Toxic Substances Control concerning the application of Executive Order (EO) D-62-02 to disposal of construction debris and whether the breakwater will be required to be removed at Diablo Canyon Power Plant".[4]

In compliance with the Commission's directive, PG&E met with the referenced agencies to confer about the EO. PG&E engaged in initial, informal communication with each agency, then scheduled in-person meetings to scope the issue and discuss each agency's role with respect to the EO and the potential retention or removal of the breakwater features.

These consultations did not provide additional clarity on the issue of in-state disposal opportunities for construction debris from DCPP. In addition to these agency consultations, PG&E contacted landfills in California to inquire whether the landfills would accept clean non-detect construction debris from DCPP. A few of the landfills contacted indicated they would accept this waste, but only if provided guidance or authority from the state to do so. PG&E concludes that there is insufficient guidance from the State for the utility or landfill operators to rely on to dispose of construction debris. Accordingly, PG&E's DCE assumes out-of-state disposal of this waste.

With regard to disposition of the breakwaters, the state agencies provided more clarity. In summary, the agencies agreed the CSLC has exclusive authority to determine whether the breakwater may be retained, modified, or removed under terms of the current lease and these actions can trigger review from the CCC.

Below are summaries of discussions with state agencies with respect to the EO and disposition of the breakwaters.

2.4.1. Executive Order D-62-02 Consultations

2.4.1.1. California Coastal Commission

PG&E met with Mr. Tom Luster from the Energy and Ocean Resource Unit on October 3, 2018. The CCC conveyed that they did not have jurisdiction in the matter, unless the issue of in-state versus out-of-state disposal is included as part of the project description for which an application is made requiring discretionary action.

2.4.1.2. California State Lands Commission

PG&E met with Executive Director Ms. Jennifer Lucchesi, General Counsel Mr. Mark Meier, Section Chief Mr. Brian Bugsch, Staff Counsel Mr. Patrick Huber, and Environmental Program Manager Mr. Eric Gillies on October 23, 2018. The CSLC conveyed that they did not have jurisdiction in the matter, unless the issue of in-state versus out-of-state disposal is included as part of the project description for which an application is made requiring discretionary action.

[4] D.17-05-020, OP 7.

2.4.1.3. California Department of Public Health

PG&E met with Branch Chief Mr. Gonzalo Perez and Mr. Ira Schneider on November 1, 2018. DPH told PG&E they do not regulate nuclear power plants and only review documents provided by the NRC as a “sister agency” to ensure nothing seems to be abnormal in its reporting on decommissioning activities within California. DPH interprets current regulations to allow construction debris from a nuclear plant that is above background levels of radiation, but below the DCGL established by the NRC, to be disposed of in a Class 1 or Class 2 landfill in California. However, DPH reiterated they do not regulate either DCPP or the landfills and they recognize the SWQCB has not issued further formal guidance to landfill operators since 2008.

2.4.1.4. California State Water Resources Control Board

PG&E met with Deputy Director Mr. Jonathan Bishop on October 8, 2018. The SWQCB informed PG&E that they are aware of the EO, have taken no further action since a memo to the Bureau of State Audits in 2008. Specifically, the memo states (See Reference 2.1):

> While the EO did include adoption of waste discharge requirements, this has not yet occurred because there would be no additional regulatory benefit gained and other high-priority work continues to compete for limited resources. Therefore, issuance of waste discharge requirements has been deferred until such time as there is a clear and compelling benefit to direct resources for such action.

2.4.1.5. Department of Toxic Substance Control

PG&E met with Project Manager Mr. William Veile on October 23, 2018. The DTSC conveyed that they did not have jurisdiction in the matter, unless the issue of in-state versus out-of-state disposal is included as part of the project description for which an application is made requiring discretionary action.

2.4.2. Breakwater Consultations

2.4.2.1. California Coastal Commission

PG&E met with Mr. Tom Luster from the Energy and Ocean Resource Unit on October 3, 2018. The CCC indicated they would require a specific application and project description to evaluate an outcome and comply with California environmental regulations regarding the breakwaters. The CCC concurred that the CSLC has exclusive authority to determine whether the breakwater may be retained, modified, or removed under terms of the current lease, which must be renewed prior to plant shut down. The CCC may have secondary permitting authority associated with disposition of the breakwaters because it may take the position that proposals to remove or retain the breakwaters constitute development under the Coastal Act.

2.4.2.2. California State Lands Commission

PG&E met with Executive Director Ms. Jennifer Lucchesi, General Counsel Mr. Mark Meier, Section Chief Mr. Brian Bugsch, Staff Counsel Mr. Patrick Huber, and Environmental Program Manager Mr. Eric Gillies on October 23, 2018. CSLC indicated they would require a specific application and project description to evaluate an outcome and comply with California environmental regulations regarding the breakwaters. The CSLC concurred that they have exclusive authority to determine whether the breakwater may be retained, modified, or removed under terms of the current lease, which must be renewed prior to plant shut down. As such, further action is required by the CLSC and PG&E before the CSLC can take action regarding retention or removal of the breakwaters. As noted in Section 3.1, proposals to remove or retain the breakwaters trigger environmental review under CEQA (or CEQA equivalent) to evaluate potential impacts and alternatives of the proposed project. The Executive Director sent correspondence to PG&E on November 21, 2018 (Reference 2.2) confirming the CSLC cannot speculate on retention of breakwaters or new lease terms until PG&E applies for its decommissioning activities (which is part of the current lease from CSLC to PG&E).

3 - MAJOR DECOMMISSIONING COST COMPONENTS

The purpose of this chapter is to describe the decommissioning activities or resources that have the greatest potential impact on the cost of decommissioning. Costs can be impacted not only by proposed activities, but also by any significant delays in implementation or changes in assumptions.

3.1. ENVIRONMENTAL REVIEWS/PERMITS REQUIRED FOR DCPP DECOMMISSIONING

The purpose of this subsection is to identify permits, and PG&E's approach to obtain those permits, which are required for decommissioning activities, including regulatory approval of future land uses, potential repurposing of assets and the demolition and restoration of the ISFSI. PG&E's decommissioning plan involves numerous agency reviews and required permits and close coordination with federal, state, and local agencies. This subsection defines the appropriate agency submittal phasing for each permit and identifies the recommended California Environmental Quality Act (CEQA) lead agency. It also responds to the Commission's directive that in the 2018 NDCTP PG&E identify the environmental reviews required for retiring DCPP.

3.1.1. Introduction

DCPP decommissioning plans will be subject to thorough environmental review as required by both CEQA and the California Coastal Act at the state level and the National Environmental Policy Act (NEPA) at the federal level. The CEQA regulations were designed to provide information about a project to the public, agencies, and decision makers; identify methods to reduce environmental impacts through alternatives and mitigation measures; disclose potential impacts, alternatives, and mitigations; and allow public participation through public forums and mandatory public comment periods on CEQA documents. The anticipated CEQA document will be a Program/Project Environmental Impact Report (EIR) that will be prepared by a third-party environmental consultant to be selected by the CEQA lead agency.

In addition to the CEQA process, the NEPA process will be stewarded by a federal agency. NEPA's purpose is to encourage harmony between people and the surrounding environment, to promote efforts to eliminate or reduce damage to the environment, and to enrich people's understanding of the ecological systems and natural resources important to the health of the United States. The anticipated NEPA documents will include an Environmental Impact Statement (EIS) from the U.S. Army Corps of Engineers (USACE) triggered by Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act, permitting activities to partially restore Diablo Creek, remove the Intake and Discharge

Structures, and potentially remove DCPP's east and west breakwaters. (Disposition of the east and west breakwaters is discussed in Section 3.2.)

Additionally, there will be a supplement to the General Environmental Impact Statement (GEIS) prepared by the NRC for terminating the Part 50 licenses. An EIS will likely be required for the partial restoration of Diablo Creek and potential breakwater removal as the limits for nationwide permits will be exceeded (e.g., greater than 25 cubic yards of discharge/fill, greater than 500 ft. (feet) of bank stabilization, etc.). In addition to the CEQA and NEPA processes, numerous subsequent permits from federal, state, and local agencies will be required to support and complete the project. Any existing operational permits that can be modified or extended to streamline the permitting process will be used.

Since both CEQA and NEPA have similar goals of environmental protection and public participation, PG&E may elect to prepare a joint CEQA / NEPA document. For the decommissioning project, PG&E anticipates this document would be a combined EIR / EIS through the formation of a Joint Review Panel (JRP). A JRP is formed by creating a memorandum of understanding (MOU) between federal and state agencies, setting forth the responsibilities of each agency during the environmental review process. For the purposes of this DCE submittal, PG&E assumes the EIR and EIS will take place separately.

Due to the complex interrelationship of key project decisions, and the uncertainty surrounding future land use and project methodologies, the decommissioning project scopes of work will be grouped into three permit submittal packages: Submittal I: Shutdown, Decommissioning and Initial Site Restoration; Submittal II: Breakwater and Intake Cove Decommissioning and Diablo Creek Restoration; and Submittal III: ISFSI Decommissioning/Restoration. This grouping will allow initial work to be analyzed and approved while still providing the agencies and decision makers the information necessary to review the entire project as required under CEQA.

To support cost estimating and strategy development, permits have been broken down into three categories based on the different types of regulatory approvals required for each:

- **Major Discretionary Permits:** Permits that require a voting body to exercise judgment or deliberation to approve or disapprove issuance of the permit at their discretion. These permits can be subject to additional special conditions as determined by the voting body.
  - Examples include the County of San Luis Obispo (County) and CCC Coastal Development Permit (CDP), California State Lands Commission (CSLC) lease or lease amendment, or other CSLC actions needed for repurposing facilities.
- **Environmental Permits:** Resource-based permits (e.g., cultural, air, biological or water permits) issued by federal, state or local agencies that can be subject to discretionary actions.
  - Examples include USACE Section 404 permit, California Department of Fish and Wildlife (CDFW) Incidental Take Permit, Central Coast Regional Water Quality Control Board (RWQCB) Section 401 Water Quality Certification, etc.
- **Ministerial Permits:** Any type of permit that the staff needs to determine whether the project conforms with applicable ordinances before approving the project.

- ☐ Examples include County grading permits, demolition permits, building permits, etc.

3.1.2. Discussion

3.1.2.1. Pre- Submittal Activities

The permitting approach to the decommissioning project includes several steps to reduce impacts to the environment and the public before the permits are submitted. This includes a project description and application submittals accompanied by an environmental assessment, with supporting technical and resource studies that describe the proposed project and avoidance and minimization measures designed to reduce or eliminate potential impacts to the public and the environment.

- A preliminary project description and initial environmental assessment will be prepared for use during initial contact with the lead and responsible agencies. This preliminary project description will include of a high-level overview of the project, decommissioning steps, time frame and anticipated permitting needs. The initial environmental assessment will consist of a preliminary review of environmental constraints to the project and proposed project design modifications that would be useful in avoiding or minimizing potential impacts.

- Baseline environmental information will be gathered for the decommissioning project through the review of existing, readily available information provided by PG&E and supplemented by site-specific technical studies. The baseline data will be used to assess potential impacts from the proposed action. This evaluation will be used to identify existing resources and potential impacts, and to propose mitigation measures that reduce or eliminate potential adverse impacts. Alternative methodologies and related impacts will be used as a basis for comparison. In addition, PG&E will provide information to show that its work complies with existing policies for the protection of resources and beneficial uses of the project area.

- PG&E will meet with representatives of federal, state and local regulatory agencies to review the decommissioning project. Among other things, they will share the preliminary project description and initial environmental assessment in order to get feedback on potential issues of concern and the need for additional site-specific data. These meetings will include applicant team members who are familiar with the engineering, environmental and permitting aspects of the decommissioning project.

PG&E will conduct pre-application meetings with the following agencies at a minimum:

- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service (USFWS)
- National Marine Fisheries Service (NMFS)
- California Coastal Commission
- California State Lands Commission
- California Department of Fish and Wildlife

- California Regional Water Quality Control Board
- State Historic Preservation Officer (SHPO)
- County of San Luis Obispo
- San Luis Obispo County Air Pollution Control District (SLOAPCD)

Once the pre-application meetings are concluded, any revisions to the proposed project changes, construction methods, etc., that have been recommended by the agencies will be analyzed by the Decommissioning Project team and, where feasible, incorporated into the project. In addition, required technical studies will be confirmed along with proposed avoidance and minimization measures.

The project will be separated into several distinct decommissioning submittal phases. For the initial permit submittal package (submittal methodologies are discussed in greater detail in Section 3.1.2.5), the application will provide a detailed description of the proposed Decommissioning Project. The project application package will include an introduction, project description, project schedule, environmental impact assessment and supporting information. After they are reviewed by the internal PG&E Decommissioning Team subject matter experts, copies will be submitted with the permit applications to each agency.

The following sections outline the recommended CEQA lead agency, as well as the proposed application submittals and methodology.

3.1.2.2. CEQA Lead Agency

The preparation of a CEQA document that adequately addresses all the relevant resource impact issues as well as project alternatives is essential to provide a solid foundation for subsequent agencies' review and approvals. Project review as required under CEQA will have a significant impact on both the final alternative selection, timing of the subsequent approvals and the resulting mitigation measures to be implemented during decommissioning. It is important to recognize that the preparation of the CEQA documentation, including scoping, preparation, public circulation (which will allow for review and comment by the public and Diablo Canyon Decommissioning Engagement Panel), and final approval has the potential to be the longest time period in the permitting process when PG&E will have minimal control.

The selection of the CEQA lead agency is a critical point in the permitting process, as the EIR can be the longest task to complete in the permitting process and PG&E will have minimal control during EIR development. Where PG&E will have the most control during the process is through pre-application and coordination meetings with the CEQA-lead agency; it will be crucial to have a collaborative working relationship with agency staff to ensure that all project application submittals are completed with the necessary level of detail. Miscommunication between PG&E and the CEQA-lead agency, or any oversights by the agency or its EIR consultant, can lead to significant project delays. For example, an EIR deemed insufficient because it does not adequately address all impacts to natural resources or does not sufficiently describe project alternatives may need to be recirculated if significant new information or mitigation needs to be added after the draft EIR has already been shared with the public. In a worst-case scenario, the EIR could be subject to a CEQA lawsuit which would result in significant delays and costs to the project.

PG&E has identified the County and the CSLC as the two likely candidates for the CEQA lead agency because of their jurisdictional issues related to the Local Coastal Program and the leases related to the breakwater, intake, and discharge structures. Furthermore, the inland portion of the project is in the County's sole jurisdiction, as it is outside the coastal zone and not on state property.

Based on consultant recommendations and experience with DCPP projects, PG&E assumes the County will serve as the lead CEQA agency for the decommissioning project.

3.1.2.3. CSLC Lease

DCPP currently maintains a lease from the CSLC to operate the breakwater, intake and discharge facilities. One of the challenges to decommissioning is that current Lease No. 9347.1 requires PG&E to either submit a Restoration Plan or a lease renewal application by August 26, 2020 -- five years prior to the lease termination. PG&E's decommissioning plan relies on using the intake and discharge facilities into the 2030s to operate the Seawater Reverse Osmosis System and to discharge previously approved levels of liquid radiological waste, among other uses.

Since PG&E intends to operate the breakwater, intake, and discharge facilities well past the current lease termination date of August 26, 2025, PG&E will need to extend the date of the lease to at least 2038. A lease extension application is a discretionary action by the CSLC, with the potential to trigger CEQA review, which would include review of the entire decommissioning project. PG&E intends to submit initial project application documents to the County as the preferred CEQA lead agency, which will then initiate the project's environmental review process. To continue planned use of the breakwater through at least 2038, PG&E will need to submit a conceptual restoration plan for the breakwater, intake, and discharge areas to the CSLC by at least August 26, 2020. The submittal of a conceptual restoration plan will allow PG&E to meet the conditions of the current lease, while allowing the CEQA process to progress at the County.

Once the draft EIR has been completed by the County, PG&E can apply for a lease renewal with the CSLC. The CSLC hearing to consider the lease extension would occur after the County certifies the EIR. The CSLC will be asked to use the County's EIR as part of the environmental review process and CSLC responsibilities under CEQA when approving the lease extension requested by PG&E.

3.1.2.4. California Coastal Commission

As discussed in Section 3.1.2.2, the Decommissioning Project application will be initiated with the County. The County has an approved Local Coastal Program (LCP) and can issue CDPs for development activities located onshore to the edge of the coastal zone, which lies approximately at the western edge of the DCPP 500kV switchyard. The CCC retains original jurisdiction from three miles offshore to the shoreline. It is anticipated that the Decommissioning Project will require three significant CDPs from the County and the CCC based on the project's extended duration and complexity.

CDPs issued by the County are appealable to the CCC. For the purposes of the Decommissioning Project and due to PG&E's experience with CDPs issued by the County for the Steam Generator (SG) Replacement Project and the ISFSI Project, PG&E assumes that each major CDP submittal will be appealed to the CCC. Projects that do not raise substantial issues typically take between two and four months to resolve. Projects that raise a substantial issue can take eight to 12 months, or longer, to resolve.

Once the CCC approves each CDP, there may be special conditions that need to be addressed prior to issuance of the CDP. An example of a special condition may be the revision of project plans to reflect project design changes approved by the CCC. Once the special conditions have been reviewed for condition compliance and all requirements have been met, the CCC will issue the CDP.

The specific scopes of work for each submittal is described in greater detail in Sections 3.1.2.7 through 3.1.2.9.

3.1.2.5. Decommissioning Project Submittals

Due to the complex interrelationship of key project decisions, and the uncertainty surrounding future land use states and project methodologies, the Decommissioning Project scopes of work will be bundled into three permit submittal packages: Submittal I: Shutdown, Decommissioning, and Initial Site Restoration; Submittal II: Breakwater and Intake Cove Decommissioning and Diablo Creek Restoration; and Submittal III: ISFSI Decommissioning/Restoration.

The term "Submittal" refers to the Land Use Application and CDP process, which will require submittal of a land use application package for the decommissioning scopes of work to the County. After receiving a Land Use Permit (LUP) and CDP from the County, and subsequent CDP from the CCC as described in Section 3.1.2.4, environmental and ministerial permits will be sought. This bundling or tiering of the Decommissioning Project components into these submittals will allow the initial work activities to be analyzed and approved while still providing the agencies and decision makers the ability to review the entire project as required under the CEQA process. This is accomplished by submitting descriptions of future work in all submittals at a programmatic level (e.g., Submittal I will include a description of work activities in Submittal II and III at a programmatic level). A discussion of project versus programmatic level descriptions is included in the following section.

3.1.2.6. Project versus Programmatic-Level Descriptions

CEQA requires projects to be described in their entirety to disclose a project's potential impacts on the local community and environment and to avoid a piecemealed evaluation. The time frame between starting decommissioning and restoring the ISFSI will likely span many decades, therefore some of the work activities will be described in broader terms (at a programmatic level) in the first and second submittals. Evaluation of work activities at a programmatic level is required as the specific methodologies for the proposed scopes of work may exist only in conceptual form and the future regulatory environment is difficult to predict. In addition, many permits are only valid for specific lengths of time. Due to these constraints, agencies responsible for discretionary permit actions will be unlikely to issue approvals for the future scopes of work so far in advance. Project and programmatic-level descriptions are defined below:

- Project-level descriptions: Addresses project-level impacts with a high degree of specificity and require a detailed project description (at a construction level) for various aspects and logistics of the entire project.
- Programmatic-level descriptions: Considers broad policy alternatives and program-wide mitigation measures that do not address site specific impacts. They are only used only when a conceptual framework is available and require subsequent CEQA review and CDPs as specific project details are formulated.

3.1.2.7. Submittal I: Shutdown, Decommissioning and Initial Site Restoration

Submittal I involves several pre-project planning objectives, including pre-application meetings with federal, state and local agencies, the selection of a CEQA-lead agency, completion of technical studies and submittal of project application documents. The Decommissioning Project dismantlement and demolition activities include several modifications to site infrastructure to facilitate work activities, as well as to provide water, power, and sanitary services to site personnel.

The scopes of work to be included at a project level in Submittal I include, but are not limited to:

- Engage in consultation with agencies to implement decommissioning strategies
- Perform project planning activities
- Engage in consultation with the County as the CEQA-lead agency
- Obtain Major Discretionary, Environmental and Ministerial permits
- Cold and Dark Modifications
- Site Infrastructure Modifications
- Site Security Modifications
- Systems and Area Closure
- SFPI Installation
- Site Characterization Study (SCS)
- Decontamination of Hazardous and Radiological Materials
- Management and Offsite Transport of Hazardous and Radiological Waste
- Spent Fuel Management
- GTCC Waste Storage
- Spent Fuel and GTCC Waste Transfer to ISFSI
- Building Demolition

- Demolition of the Intake and Discharge Structures
- Initial Site Restoration Activities
- RPV and Internals Removal and Disposal
- Large Component Removals
- Water Management, including the management of the Desalination Plant and Liquid Radioactive Waste
- Removal of the 230kV switchyard
- Building and use of the Pismo Beach Material Handling Facility rail spur to transport radiological waste
- Spent Fuel Transfer to DOE
- Potential repurposing and reuse of assets

The scopes of work to be included at a programmatic level in Submittal I include, but are not limited to:

- Demolition and Restoration of the east and west breakwaters
- Potential repurposing and reuse of assets
- Partial restoration of Diablo Creek
- Final Site Restoration, including conceptual descriptions of final grading, landscaping and long-term stormwater management
- ISFSI-only Operations
- Offloading of Spent Nuclear Fuel and GTCC Waste from ISFSI to the DOE
- ISFSI Demolition
- ISFSI Restoration

When the Part 50 operating licenses expire, they become possession-only. A possession-only license allows PG&E to possess radioactive materials such as spent nuclear fuel and reactor-related GTCC waste. The Part 50 possession-only licenses can be terminated by the NRC after radiological remediation at the conclusion of the project-level work activities associated with Submittal I.

3.1.2.8. Submittal II: Breakwater and Intake Cove Decommissioning, and Diablo Creek Restoration

Submittal II will be prepared and submitted to the CEQA-lead agency during Submittal I work activities to avoid delay in starting the Submittal II work activities. Submittal II work activities are expected to begin after building demolition activities are completed, as noted above in Submittal I. Activities for Submittal I and II will partially overlap, because final status surveys, structure demolition and backfill / grading activities described at a project level in Submittal I will still be ongoing when Submittal II activities are scheduled to start. The ISFSI-only operations are planned to begin in 2038 after site restoration activities are completed. Restoration activities within Diablo Creek will include only partial restoration, as multiple sections of the creek, including areas underneath the 500kV switchyard, will not be restored.

At this point, most of the site will be in active restoration and only the following buildings will remain in place: temporary buildings and infrastructure needed to support site personnel, the Cold Machine Shop, the ISFSI and associated security building and infrastructure, the firing range and the 500kV switchyard and site access roads.

The scopes of work to be included at a project level in Submittal II include, but are not limited to:

- Potential demolition and restoration of the east and west breakwaters
- Partial restoration of Diablo Creek
- Final Site Restoration, including final site contouring and long-term stormwater management
- Continued Spent Fuel Transfer to DOE
- ISFSI-only Operations

The scopes of work to be included at a programmatic level in Submittal II include, but are not limited to:

- ISFSI Demolition
- ISFSI Restoration
- Future Land Use and potential repurposing

3.1.2.9. Submittal III: ISFSI Decommissioning/Restoration

Submittal III will be prepared and submitted during ISFSI-only operations approximately eight years prior (expected submittal in January 2060) to the proposed start of ISFSI Decommissioning / Restoration work activities. After obtaining Submittal III permits, work activities will begin once all spent fuel and GTCC waste have been transferred to the DOE or to a third-party licensed storage facility. Most of the remaining site structures and infrastructure will be removed during this time frame, including the ISFSI security building, firing range, spent fuel and GTCC Waste Heavy Haul transfer dock, any remaining water, electrical, and sewer infrastructure for site personnel, and all 230kV towers located on the property. The only remaining structures will be the 500kV switchyard and associated towers required for grid voltage and maintenance support and any impoundments related to long-term stormwater management. In addition, the north and south access roads, and roads to access the 500kV switchyard will remain.

3.1.3. Existing Permits to be Modified or Extended

DCPP and the ISFSI currently have several operating permits in place that are required to operate. Many of these permits will no longer be required once the plant ceases to operate, however some of the permits are vital to continue operating certain systems to support decommissioning activities. Each operating permit has been evaluated for its necessity to support decommissioning activities. Permits that are not required for decommissioning will be terminated or allowed to expire upon Unit 2 shutdown. Required permits will be renewed as necessary to support the associated decommissioning activities. Table 3-1 below lists all operational DCPP and DC ISFSI permits, the issuing agency and authority, permit number, current issue, and expiration dates, covered activity and the applicable decommissioning submittal(s).

Table 3-1: Existing Permits to be Modified or Extended

Agency	Permit	Permit Number	Activity Covered	Required for Submittal I, II, or III Activities
Central Coast Regional Water Quality Control Board	National Pollutant Discharge Elimination System Permit	CA0003751	Waste Discharge Requirements for Pacific Gas and Electric Company Diablo Canyon Nuclear Power Plant Units 1 and 2 San Luis Obispo County	I
California Coastal Commission	Coastal Development Permit	A-4-82-593	Construction of the Simulator/ Training Building	N/A
California Coastal Commission	Coastal Development Permit	A-3-SLO-04-035	Construction and operation of ISFSI	N/A
California Coastal Commission	Coastal Development Permit	A-3-SLO-06-017 and E-06-011	Steam Generator Replacement Project	N/A
State Water Resources Control Board	Industrial Stormwater General Permit (IGP)	2014-0057-DWQ	Storm Water Discharges to Diablo Creek and the Pacific Ocean	N/A
State Lands Commission	Lease	9347.1	Right-of-Way for Breakwaters and Intake/ Discharge Structures	I, II
U.S. Department of Interior	Right-of-Way	CACA 55237	Right-of-Way for Construction and Maintenance of Breakwaters	I, II

Agency	Permit	Permit Number	Activity Covered	Required for Submittal I, II, or III Activities
California Department of Toxic Substances Control	Resource Conservation and Recovery Act (RCRA) Equivalent Waste Treatment Storage and Disposal Facilities (TSDF) Permit	CAD0779663 49	Operation of Hazardous Waste Facility at DCPP	I
San Luis Obispo County Environmental Health Department	Permit to Operate	0301 PR0002823 (UST) 0728 PR0002022 (HM) 1126 PR0002512 (HW) 1201 PR0015253 (AST)	Operation of underground and aboveground petroleum storage tanks, hazardous materials handling, hazardous waste generation, SPCC Plan	I, II, III
San Luis Obispo County Environmental Health Department	Permit to Operate	0726 PR0001853 (HM)	Emergency Operations Facility (EOF) Hazardous materials handling and operation of aboveground petroleum storage tank	I

Agency	Permit	Permit Number	Activity Covered	Required for Submittal I, II, or III Activities
San Luis Obispo County Environmental Health Department	Permit to Operate	0726 PR0016555 (HM)	SLO Kendall Road Campus Facility Hazardous materials handling and operation of aboveground petroleum storage tank	I
National Marine Fisheries Service	Biological Opinion and Incidental Take Statement	--	Possession and disposition of impinged or stranded sea turtles	I
San Luis Obispo County Air Pollution Control District	Permit to Operate	338-1	Operation of DCPP Paint Spray Booth	I, II, III
San Luis Obispo County Air Pollution Control District	Permit to Operate	546-2	Operation of a DCPP Non-Retail Gasoline Dispensing Facility	I, II, III
San Luis Obispo County Air Pollution Control District	Permit to Operate	886-2	Operation of the EOF Stationary Emergency Diesel Generator	I
San Luis Obispo County Air Pollution Control District	Permit to Operate	919-4 (Revised in 2017 to add Bldg 113 generator)	Operation of DCPP Stationary Emergency Diesel Generators	I
San Luis Obispo County Air Pollution Control District	Permit to Operate	1065-7 Permit revised 2017. New units added, old units removed.	Operation of DCPP Routine-Use Portable Diesel-Powered Internal Combustion Units	I, II, III
San Luis Obispo County Air Pollution Control District	Permit to Operate	1820-1	Operation of the Joint Information Center (JIC) Stationary Emergency Diesel Generator	N/A

Agency	Permit	Permit Number	Activity Covered	Required for Submittal I, II, or III Activities
San Luis Obispo County Air Pollution Control District	Permit to Operate	1845-3	Operation of DCPP Emergency-Use Portable Diesel-Powered Water Pumps	I, II
San Luis Obispo County Air Pollution Control District	Permit to Operate	1946-1	Operation of SLO Kendall Road Campus Emergency Diesel Generator	N/A
San Luis Obispo County Air Pollution Control District	Permit to Operate	1980-1	Operation of DCPP Emergency-Use Portable Diesel Powered Electric Generators	I, II, III
San Luis Obispo County Public Health Department	Non-Community Drinking Water System Permit	PT 0004769	Authorization to Operate Non-Community Drinking and Domestic Water System	I
California Secretary of Resources	License	710027-01	Surface Canopy Kelp Harvesting	I
California Secretary of Resources	Special Use Permit	710006-02	Removal of Benthic Kelp from the DCPP Intake Cove Exclusion Zone	I

3.1.4. Required Permits for Decommissioning

Several permits are required to complete DCPP decommissioning activities. Table 3-2 below lists the expected required permits, the issuing agency, and the permit type. In addition, for each permit the table indicates which decommissioning submittal(s) the permit will be required to support. Some of these permits will be obtained by modifying or extending of an existing permit identified in Table 3-1. In many cases, permits will need to be obtained to support decommissioning activities in multiple submittals.

Table 3-2: Required Decommissioning Permits

Agency	Permit/ Approval	Notes	Category	Submittal 1	Submittal 2	Submittal 3
California Coastal Commission	License Termination under 10 CFR Sections 50.75, 50.82, 51.53, and 51.95. Coastal Zone Management Act (CZMA) Review. Application and certification through CCC	Federal review required for local actions to determine consistency with CZMA Plans.	Major Discretionary	Y	N	Y
U.S. Environmental Protection Agency	Concurrence on license termination plan under specific circumstances defined in the NRC/EPA Memorandum of Understanding. Review and approval of site remediation plans.	NRC to consult with EPA when (1) radioactive groundwater is in excess of EPA's maximum contaminant limits; (2) NRC contemplates either restricted release or use of alternative criteria for license termination; or (3) hazardous materials are involved that are not under NRC jurisdiction. Any plan that includes Final Status Surveys (FSSs) or liquid radioactive waste (LRW) (LRW) treatment	Environmental	Y	N	Y
U.S. Army Corps of Engineers	Section 404 Permit	Complete Section 404 permitting to conduct any activity that might result in a discharge of excavated or fill material in wetlands, streams, rivers, and other U.S. waters (federal jurisdictional waters). Any plans that are putting dirt or solid material into a stream that is under USACE jurisdiction.	Environmental	Y	Y	Y
	Section 10 Rivers and Harbors Act	Complete Section 10 permitting to conduct any activity that might result in an obstruction or alteration of any navigable water of the U.S. that is under USACE jurisdiction.	Environmental	Y	Y	N
U.S. Fish and Wildlife Service	Consultation – Endangered Species Act (ESA)	The USACE may consult with this agency as part of the 404 permitting process regarding potential impacts to federally threatened and endangered species (Section 7). Any plan that is impacting a federally listed plant or animal or their habitat	Environmental	Y	Y	Y
National Marine Fisheries Service	Consultation – ESA, Marine Mammal Protection Act and Essential Fish Habitat Assessment.	The Magnuson Stephens Fishery Conservation and Management Act/ESA – As part of the 404 permitting process, the USACE may consult with this agency regarding whether the project would adversely affect critical habitat for listed anadromous fish species and essential fish habitat (Section 7). Any plan that is impacting a federally listed plant or animal or their habitat or direct impacts to federally listed anadromous species. Essential Fish Habitat Assessment required for issuance of other federal authorizations. Potential for Incidental Take Authorization under the Marine Mammal Protection Act for use of heavy marine equipment or explosive demolition activities.	Environmental	Y	Y	N
California Air Resources Board (CARB)	Portable Equipment Registration Program (PERP) Registration for Qualifying Uses, over 50 HP, generally not to exceed 12 months' use.	PERP registrations for applicable units are required upon delivery of unit to the site. Any plan that involves use of portable equipment over 50 HP	Ministerial	Y	Y	Y
California Office of Historic Preservation	Consultation pursuant to the National Historic Preservation Act (NHPA)	The NHPA – As part of the 404 permitting process, the USACE should consult with this agency to determine whether the project would adversely affect historic properties. Any plan that involves earth work near an archeological site (e.g., SLO-2).	Environmental	Y	Y	Y

Agency	Permit/ Approval	Notes	Category	Submittal 1	Submittal 2	Submittal 3
California Department Toxic Substances Control (DTSC)	RCRA Permit and consultation on final hazardous material remediation. Statement of basis to select final remedial actions. Also, administers state hazardous waste management regulations.	DTSC designated as the lead state oversight agency for soil and groundwater remediation. Cleanup pursuant to Voluntary Cleanup Agreement or Corrective Action pursuant to RCRA. Any plan that involves hazardous material remediation	Environmental	Y	Y	Y
Regional Water Quality Control Board	Waste discharge requirements (WDR)	Required for discharges of waste to water or land that could affect the quality of waters of the state.	Environmental	Y	Y	Y
	NPDES permit	Required for discharges of waste to surface waters deemed waters of the United States.	Environmental	Y	Y	N
	Construction storm water general permit	Required for ground disturbance of one or more acres. Requires application for construction general permit and preparation of a SWPPP. A Construction General Permit would be required for decommissioning activities because it will involve more than an acre of ground disturbance.	Environmental	Y	Y	Y
	Section 401 Water Quality Certification	A 401 Water Quality Certification would be required if a 404 permit is required from the USACE. A 401 Water Quality Certification would be required if impacts result in State waters.	Environmental	Y	Y	Y
California Department of Fish and Wildlife	Streambed Alteration Agreement (SAA)	A Streambed Alteration Agreement would be required if decommissioning activities would substantially divert or obstruct the natural flow of a stream; substantially change or use any material from the bed, channel or bank of a stream; or deposit debris, waste or other material.	Environmental	Y	Y	Y
	License for Kelp Removal	Surface canopy kelp harvesting	Environmental	Y	Y	N
	Special Use Permit	Removal of Benthic Kelp from the DCPP Intake Cove Exclusion Zone. Activities potentially impacting the Point Buchon MPA.	Environmental	Y	Y	N
	Incidental Take Permit (ITP)	Take of California List Species	Environmental	Y	Y	Y
State Lands Commission	Lease or Lease Amendment/Quit Claim or Lease Termination Agreement	A new lease or lease amendment may be required if decommissioning activities would modify either the Intake or Discharge Facilities. If no re-purposing alternative is implemented, a Quit Claim of the tidelands lease will be required after removal of all improvements or Lease Termination Agreement to cover any abandoned-in-place items.	Major Discretionary	Y	Y	N
California Coastal Commission	Coastal Development Permit/Federal Consistency Review	Serves as the primary state development permit required for any decommissioning activity that involves placement or removal or material in the coastal zone. Covers in-shore facilities and on-shore to ~western edge of 500kV switchyard. Review of all federal approvals and actions for consistency with the CZMA.	Major Discretionary	Y	Y	Y
California Public Utilities Commission	Notice of Construction Approval	Required per General Order 131-D	Major Discretionary	Y	N	N
San Luis Obispo County Planning and Building Department	Coastal Development Permit	A CDP is required from the County of San Luis Obispo and/or the CCC. Covers on-shore to ~western edge of 500kV switchyard. If both these agencies agree to consolidate processing, then a CDP would only be required from the CCC.	Major Discretionary	Y	Y	Y
	Grading Permit	Grading Permits requiring a minor use permit or development plan. For grading or excavations >5,000 cu. yards.	Major Discretionary	Y	Y	Y
	Grading Permit	Minor grading permits. For grading or excavations >50 cu. yards and <5,000 cu. yards.	Ministerial	Y	Y	N

Agency	Permit/ Approval	Notes	Category	Submittal 1	Submittal 2	Submittal 3
	Demolition Permit	A demolition permit would be required for demolition of one or more structures.	Ministerial	Y	Y	Y
	Building Permit	A building permit would be required for modification to, or construction of, one or more structures.	Ministerial	Y	Y	N
San Luis Obispo County Environmental Health Department	Permit to Operate (PTO)	Operation of underground and above ground petroleum storage tanks, hazardous materials handling, hazardous waste generation, SPCC Plan, or Hazardous Materials Business Plan (HMBP)	Environmental	Y	Y	Y
San Luis Obispo County Public Health Department	Non-Community Drinking Water System Permit	Authorization to Operate Non-Community Drinking and Domestic Water System	Environmental	Y	N	N
San Luis Obispo County Public Works	Transportation permit for county roads	SLO Public Works Transportation permit for county Roads Heavy haul or oversize loads.	Ministerial	Y	Y	N
	Encroachment Permit	SLO Public Works Encroachment Permit for work within County roads	Ministerial	Y	Y	Y
California Department of Transportation (Caltrans)	Transportation permit for state highways	Heavy haul or oversize loads. Information on heavy haul and oversized loads is available at http://www.dot.ca.gov/hq/traffops/permits/index.htm.	Ministerial	Y	Y	N
California Highway Patrol (CHP)	California Highway Patrol escort required depending on width of load and route taken	Information on escort and pilot car requirements is available at http://www.dot.ca.gov/hq/traffops/permits/pcmaps.htm.	Ministerial	Y	Y	N
San Luis Obispo Air Pollution Control District	Authority to Construct (ATC)	ATC required for building, erecting, altering or replacing any article, machine, equipment or other project, whose use may cause air contaminants to be released. Construction of the Rad Waste Water Processing Facility and Waste Management Facility will require an ATC.	Environmental	Y	Y	Y
	Permit to Operate	PTO required before any article, machine, equipment or other project, whose use may cause, increase, eliminate, reduce or control air contaminants to be released. Contaminated soil management and operation of diesel-powered construction equipment will require a PTO.	Environmental	Y	Y	Y
	National Emission Standards for Hazardous Air Pollutants (NESHAP) Notification	Demolitions of any kind of structure or asbestos-containing material disturbance are required to be approved in advance by SLOAPCD. Includes demolition of concrete structures, buildings, thermal insulation, pipelines, etc.	Environmental	Y	Y	Y
Out of State Transportation Permits	As Applicable	Any transportation permits required for out of state transportation (waste disposal, etc.)	Ministerial	Y	Y	Y
Department of Interior - Bureau of Land Management (BLM)	Right-of-Way-Sundry	Right-of-way for construction and maintenance of breakwaters	Environmental	Y	Y	N
U.S. Coast Guard	Notice to Mariners and Removal of Navigational Buoys	Notifications regarding transport of hazardous and none hazardous materials by water. Marine vessel movements associated with demolition activities.	Ministerial	Y	Y	N
California Division of Occupational Safety and Health (Cal OSHA)	Cal-OSHA General Construction Activities Permit	Submittal of notification of construction activities, including construction of buildings, demolition of buildings, use of scaffolding over 36 ft., and excavations.	Ministerial	Y	Y	Y
U.S. Environmental Protection Agency	Lead Notification	Submittal of notification of lead abatement activities.	Ministerial	Y	Y	Y
U.S. Department of Transportation (DOT)	Hazardous Materials Safety Permit (HMSP) from Federal Motor Carrier Safety Administration (FMCSA)	HMSP from the FMCSA. For radioactive materials, this is only applicable for highway transport.	Ministerial	Y	Y	Y
Union Pacific Rail Road (UPRR)	Right-of-Entry	Projects involving temporary use of railroad property	Ministerial	Y	Y	Y

3.1.5. Ministerial Permitting

To ensure efficient and timely acquisition of ministerial permits from the County of San Luis Obispo Planning and Building Department, PG&E will negotiate with the County to utilize onsite planning and building staff during the Decommissioning project. PG&E proposes utilizing 1 Full-Time Equivalent (FTE) for a construction site inspector, 1 FTE for a building inspector, and 0.5 FTE for a plan check engineer. PG&E will house County staff utilizing existing onsite office space. PG&E would begin funding onsite County staff several months prior to the expiration of the Unit 2 license to reduce the likelihood of delay in the start of decommissioning activities.

County staff would be onsite starting April 2025 and continue through May 2035. PG&E anticipates less County staffing will be needed during the removal of the breakwater, during which time 0.5 FTE for a plan check engineer and 0.5 FTE for a construction site inspector from the period of June 2035 through December 2038. Onsite County staffing will not be required during the ISFSI-only period after removal of the breakwater. Onsite County staffing would resume during demolition and restoration of the ISFSI, utilizing 0.5 FTE for a plan check engineer and 0.5 FTE for a construction site inspector planned for November 2067 through December 2068. PG&E estimates costs related to County Planning and Building ministerial permits to be approximately $9.5 million utilizing this approach. Table 3-3 provided below details the expected costs.

Table 3-3: San Luis Obispo County Ministerial Permit Costs

Start of Decommissioning to Breakwater Removal Period				
County Staff Designation	**FTE Equivalency**	**Period**	**Number of Months**	**Total (2017$) (thousands)**
Plans Examiner	1	April 2025 – May 2035	122	$3,099
Building Inspector	1.5	April 2025 – May 2035	122	$4,963
			Subtotal:	$8,062
County Staff Designation	**FTE Equivalency**	**Period**	**Number of Months**	**Total**
Plans Examiner	0.5	June 2035 – Dec. 2038	43	$532
Building Inspector	0.5	June 2035 – Dec. 2038	43	$567
			Subtotal:	$1,099
County Staff Designation	**FTE Equivalency**	**Period**	**Number of Months**	**Total**
Plans Examiner	0.5	Nov. 2067 – Dec. 2068	14	$167
Building Inspector	0.5	Nov. 2067 – Dec. 2068	14	$179
			Subtotal:	$346
			Total All Periods:	$9,507

Costs for permits required for compliance with CARB regulations, transportation permits through the County of San Luis Obispo, transportation permits through Caltrans, CHP escort fees, out-of-state transportation permits, and hazardous materials safety permits through the U.S. Department of Transportation are being captured in the DCE sections respective to the work scope. The acquisition of these permits will be the responsibility of the contractor performing the scope of work, with compliance and oversight to be provided by onsite PG&E oversight staff.

Permits / notifications related to the U.S. Coast Guard Notice to Mariners, Cal-OSHA General Construction Activities Permit, and EPA Lead Abatement Notifications are level of effort tasks which will be handled by onsite PG&E permitting and compliance staff.

Encroachment permits for the County of San Luis Obispo Public Works Department and the UPRR cost $371 and $1,045 per occurrence, respectively. PG&E anticipates the need for approximately 12 encroachment permits from the County and one encroachment permit for the UPRR. Total costs for these permits are estimated at $5,497.

The combined total estimate for ministerial permits from all direct-fee (payment to agency) costs in this section is estimated at $9.5 million.

Expected ministerial permits have been identified in Table 3-2 and costs have been identified in this section, however, until the CEQA process and EIR are complete and other major discretionary permits have been acquired, costs for ministerial permits cannot be accurately estimated at this time. Additionally, the outcome of negotiations between PG&E and the County regarding the use of onsite County staff could change the overall cost for ministerial permits. The estimates for ministerial permitting in this section are based on PG&E's historical project experience at DCPP and HBPP. PG&E will provide a more detailed estimate and schedule for ministerial permits during the 2021 and 2024 NDCTP filings.

3.1.6. Water Management Plan Agency Approval Assumptions

This subsection illustrates how failure to obtain agency approvals could have a major impact on estimated costs.

3.1.6.1. Water Requirements

During power operations, DCPP produces its own supply of fresh water and processes various waste waters suitable for discharge. PG&E relies on seawater to produce fresh water at its desalination plant for fresh water production; to flush processed waste water; and to provide an adequate dilution volume to meet discharge requirements for processed liquid radiological effluent and brine discharge from the desalination plant. During decommissioning, PG&E will need to dispose of contaminated water left over from power operations; dispose of additional waste water that will be produced to support decommissioning; and continue to receive a supply of fresh water through ISFSI site restoration activities.

The equipment currently relied upon for waste water disposal and water supply will be removed as part of decommissioning, and existing permit conditions to discharge waste waters are expected to change, therefore a plan is developed to manage water needs within regulatory requirements during decommissioning. The strategy to handle waste water and produce fresh water is referred to as the "water management plan." In developing this plan, the following decommissioning water needs were considered:

- LRW disposal
- Equipment, structure and tool decontamination
- Accumulated stormwater and groundwater discharge
- Sanitary waste water disposal
- Drinking water supply
- Dust suppression
- Replanting and site restoration
- Fire suppression
- SFP inventory management
- Dilution volume for the brine discharge from the desalination and drinking water plant

The water management plan is a strategy for handling the water needs listed above. In general, the water management plan begins with using existing plant equipment, then transitions to temporary equipment as existing equipment is removed from service, and finally uses trucks when nearly all demolition activities are complete through ISFSI site restoration. The water management plan was separated into five different functions: Dilution and discharge, fresh water / drinking water supply, groundwater treatment system, sanitary water discharge and liquid radiological water processing. These five functions are summarized as follows:

Dilution and Discharge: Following plant shutdown, the once-through cooling water flow, which normally provides a way to dilute brine from the desalination plant and processed LRW will be greatly reduced immediately and continue at a reduced flowrate until no longer needed for SFP operations. To continue operating the desalination facility and discharge of LRW, a temporary system will be installed to circulate ocean water to receive waste water streams. The system also will feed ocean water to the desalination plant to convert to fresh water. This temporary system, which consists of pumps installed on a barge and aboveground piping, will pump water from the intake cove to the discharge structure and will remain in service until most of the site restoration activities are complete.

Fresh Water / Drinking Water Supply: Fresh water supply is provided by the desalination plant with supplemental water provided by a well. The reliability of the well is vulnerable to droughts and cannot be relied upon as a primary source of water for decommissioning. Therefore, with the availability of the temporary system to provide dilution and discharge, the desalination plant will continue to operate until most of the site restoration activities are complete. After this, water will need to be trucked onto the site to be used for such things as potable water for sanitation purposes and to meet permit compliance conditions such as dust control during grading and demolition work to reduce airborne contaminates. Trucking of water from off site will be required until ISFSI site restoration activities are completed.

Sanitary Water: The onsite sanitary waste water system will continue to operate until the discharge structure demolition activities begin. Once the discharge structure is removed from service, portable facilities and sanitary holding tanks will be relied upon to handle personnel needs. The use of these types of facilities will require wastewater trucks to empty them and then transport contents off site. The use of portable toilets and sanitary holding tanks will continue through ISFSI site restoration activities.

Liquid Radiological Water Processing: Immediately after unit shutdown, existing plant systems will be used to process and dispose of LRW inventories left over from full power operations. This evolution is expected to occur while the once-through cooling system for the SFP is still available to discharge the LRW effluent. During this time, a temporary liquid radiological water processing system will be installed and tied into the temporary dilution and discharge system.

To develop its cost estimate for the water management plan, PG&E has made two assumptions with major financial implications: (1) PG&E will obtain an extension of its lease from the CSLC to continue using the intake cove and discharge structure for drawing in ocean water and discharging waste water to the ocean; and (2) PG&E will obtain a NPDES permit to allow for discharges of waste water to the Pacific Ocean during decommissioning. With these assumptions, the water management plan uses a combination of existing site infrastructure and temporary equipment to continue providing ocean water to the desalination plant for fresh water supply and to dispose of waste water to an approved discharge point.

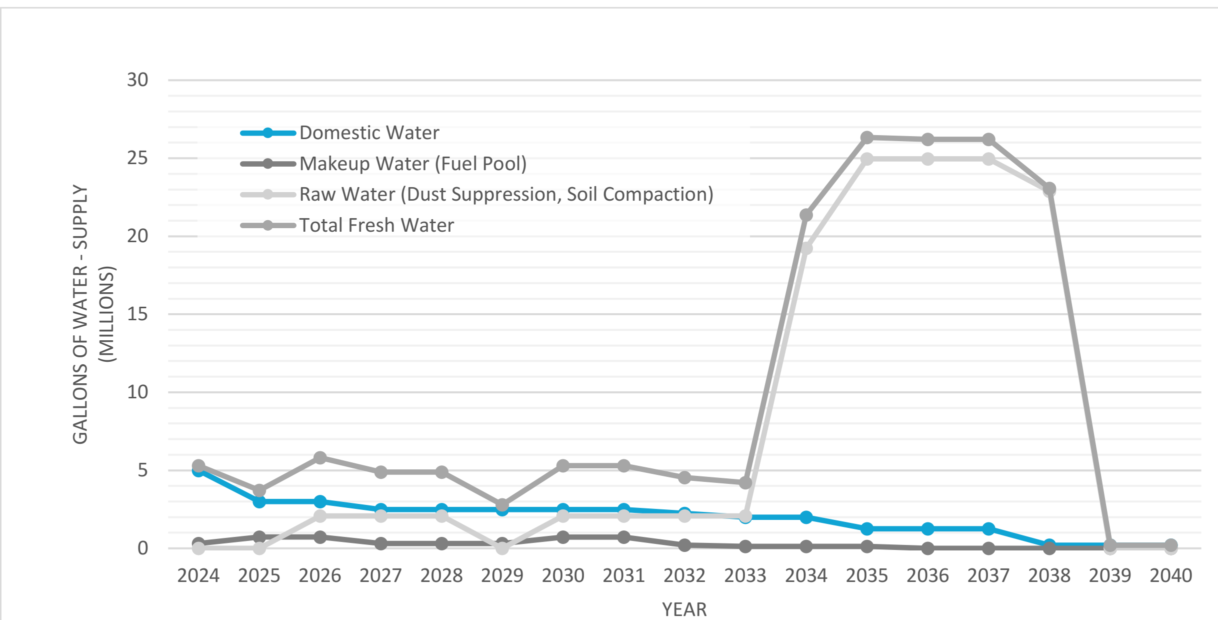
However, the CSLC lease for access to the Pacific Ocean through the intake cove and discharge structure expires in August 2025. In addition, existing permit conditions for the DCPP site to discharge waste waters are specific for power generation purposes, and the use of similar discharge paths would need to be reviewed and approved for decommissioning.

Both the lease and the NPDES permit are needed to support the current water management plan; failure to receive either of these would result in additional costs. In their absence, PG&E would lack access to the Pacific Ocean and would need to develop other water use options. The options that could be considered include the use of trucks, the installation of additional water wells, construction of water storage, and the installation of pipelines to tie into local water providers. Of these, the most feasible alternative to manage water appears to be to use trucks to ship fresh water to the site and waste water off site.

The proposed water management plan would use the Pacific Ocean for water management when most of the project activities are occurring and to use trucks approximately 13 years into decommissioning (2039) as site restoration is completed. Site restoration activities, such as backfilling, grading and replanting, begin to occur as demolition activities are complete. If PG&E is unsuccessful in obtaining the rights to use the ocean as planned, then it would need to use trucks much earlier in the decommissioning process.

PG&E estimated the number of trucks needed to supply water to the site based primarily on the daily use of water for site personnel, SFP makeup, dust suppression and soil compaction activities. The amount of fresh water per year that is projected for this 15-year period is illustrated in Figure 3-1. It's assumed that 24 gallons per person will be used per day (gpd) for personnel, 500 gpd for SFP makeup, 10,000 gpd for building demolition and 110,000 gpd for site restoration. Starting in 2039, as site restoration activities are completed, water use is expected to decrease to approximately 200,000 gallons per year (0.6 acre-ft. per year), to provide domestic water for plant personnel.

Figure 3-1: Yearly Fresh Water Supply Needs during Decommissioning



Discharge of waste water to the Pacific Ocean is also part of the proposed plan. Again, if the ocean cannot be used then this water would have to be trucked off site. Figure 3-2 provides the amounts of waste water per year for the same 15-year period that is shown in the previous graph. However, for waste water, trucking will be implemented when demolition of the discharge structure begins around 2033. Liquid Radiological Waste processing of the largest volumes of water -- two reactor cavities and two SFPs -- is planned to be completed just prior to the start of discharge structure demolition. After 2033, LRW effluent will be assumed to be zero gallons. With that, the existing plan will ship miscellaneous LRW waters that are collected as a result of LRW volumes that were not discharged or rainwater that is collected and found to be contaminated.

Figure 3-2: Yearly Waste Volumes during Decommissioning

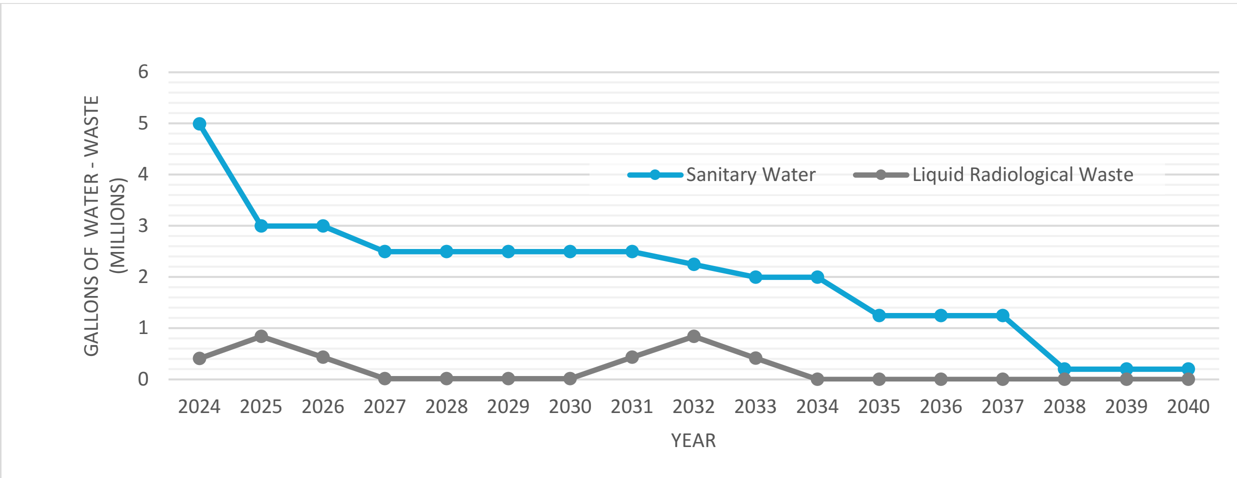
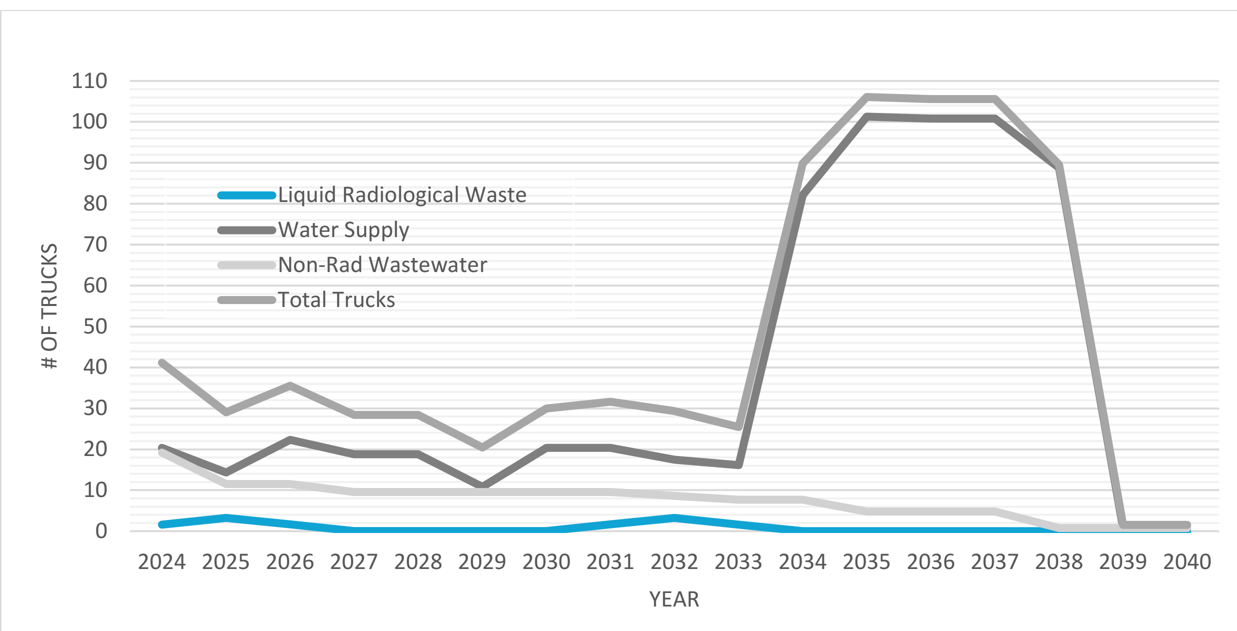


Figure 3-3 converts water amounts per year into number of round trips of trucks per week. The truck size capacity assumed in this graph is 5,000 gallons. Converting from gallons per year to trucks per week seems appropriate to gauge the amount of traffic that will be present during decommissioning if trucking is required. Figure 3-3 shows about 30 trucks per week for the first eight years of decommissioning, with a sharp rise of just over 100 trucks per week as site restoration activities begin.

Figure 3-3: Average Number of Round Trips of Trucks per Week



The number of trucks in the previous graph is averaged over the year to provide a general idea of how many trucks should be expected on a weekly basis. However, this technique masks the likely trucking strategy for shipping LRW off-site. Primarily, large inventories of LRW become available based on the location of the spent fuel. For example, when all the spent fuel is placed into dry storage, approximately 400,000 gallons of water in the SFP becomes immediately available for disposal. Inventories of this size will need to be shipped in a relatively short time frame because there is no place to store this water outside the pool. Furthermore, water inventory in the SFP needs to be disposed of immediately so that it won't impact the demolition of the pool and the surrounding structures. In Figure 3-3 the number of trucks needed to dispose of LRW averages out to about one to four round trip trucks per week over the year. Figure 3-4, below, indicates what years are expected to see these large inventories of water become available for disposal. Assuming two weeks to allow for the removal of a source of a LRW inventory from site, about 40 round trips will be needed per week. For years when Figure 3-4 shows 160 trucks per year, this should be interpreted as 40 round trips of trucks per week for four weeks.

Figure 3-4: Number of Round Trips of Trucks per Year to Ship Liquid Radiological Waste

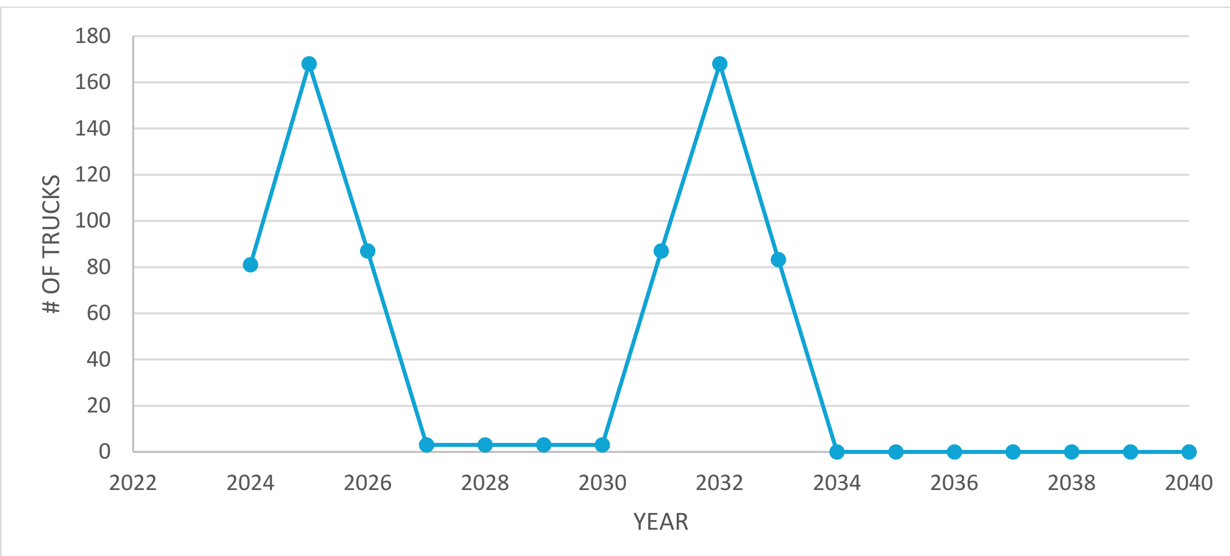


Table 3-4 compares the use of trucks between plans that use the ocean during high water use and the alternative if permits are not granted. With permits, the use of trucks is implemented when water demands begin to decrease -- in 2035 for wastewater and 2039 for fresh water supply. Without permits, trucks will start being used when decommissioning begins; therefore, traffic will be impacted in the first 13 years. In addition, reliance on the local community's water supply would leave the project vulnerable to water restrictions, specifically during times of drought which may delay project completion.

Table 3-4: Use of Trucks (round-trips per week)

With Leases and Permits	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
LRW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Freshwater	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.8
Wastewater	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	4.8	4.8	0.8	0.8	0.8
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	4.8	4.8	0.8	1.5	1.5

Trucking Only	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
LRW	3.2	1.7	0.1	0.1	0.1	0.1	1.7	3.2	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Freshwater	14.3	22.3	18.8	18.8	10.8	20.3	20.3	17.5	16.2	82.2	101.3	100.8	100.8	88.8	0.8	0.8
Wastewater	11.5	11.5	9.6	9.9	9.6	9.6	9.6	8.6	7.7	7.7	4.8	4.8	4.8	0.8	0.8	0.8
Total	29.1	35.5	28.4	28.4	20.4	30.0	31.6	29.3	25.4	89.8	106.1	105.6	105.6	89.5	1.5	1.5

Provided the permits and lease are granted to use the ocean, decommissioning will be self-sufficient, with minimal reliance on the communities' water -- a continuation of how water is managed during full power operations. Trucking is planned to start only when water demands are decreasing and the equipment that is relied upon for water management is removed as part of decommissioning.

3.2. DCPP BREAKWATER FACILITIES REMOVAL

3.2.1. Description of Breakwater Facilities (a sub-set of the overall marine facilities)

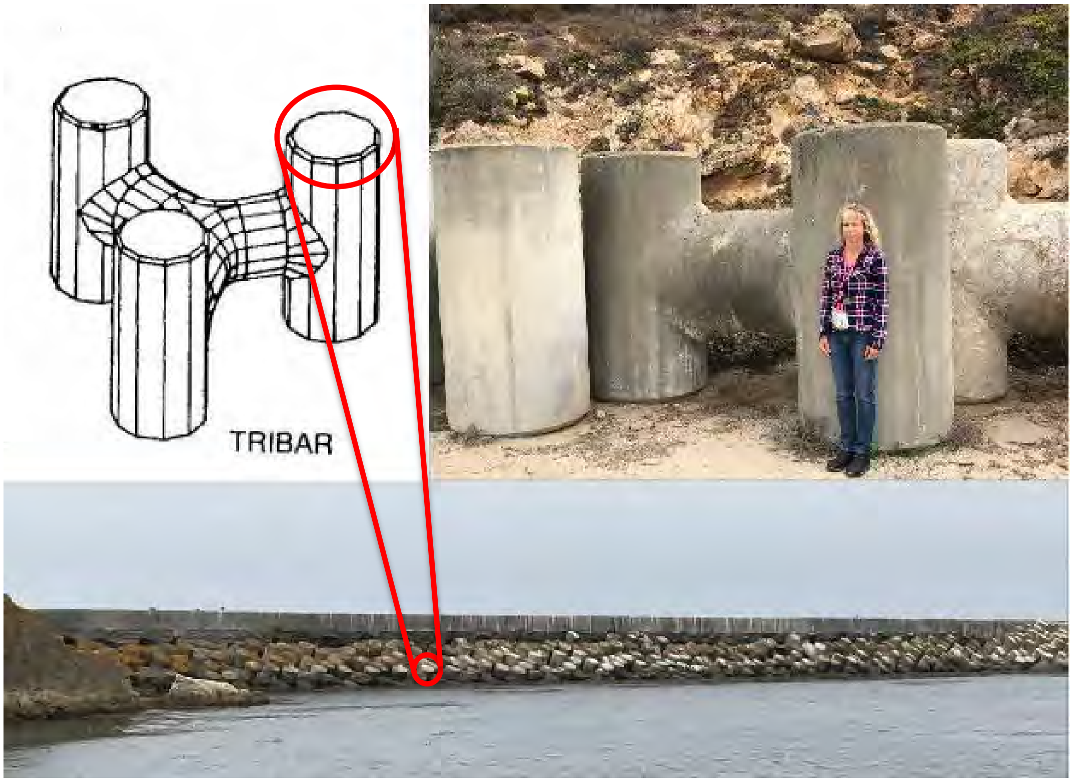
As part of its once-through cooling (OTC) System, DCPP has structures that are situated on tide and submerged lands in and adjacent to the Pacific Ocean. These are the Cooling Water Intake Structure, Breakwaters, and the Cooling Water Discharge Structure (see Figure 3-5 and Figure 3-6). The DCPP circulating water system draws water from the Pacific Ocean via the cooling water intake structure. Breakwaters extend from two points into the ocean, creating an area of calm surface water around the intake structure. The breakwaters are built from man-made interlocking concrete tri-bar (concrete block in a complex geometric shape weighing up to 38 tons) and used to protect harbor walls from the erosive force of ocean waves (see Figure 3-7).

As discussed below, these structures are subject to CSLC Lease No. PRC 9347.1.

Figure 3-5: DCPP's Intake Structure, Breakwaters, and Discharge Structure Looking North

Figure 3-6: DCPP's Intake Structure, Breakwaters, and Discharge Structure Looking Southeast

Figure 3-7: Concrete Tribar



3.2.2. California State Land Commission Lease Requirements

Prior to construction of DCPP, PG&E obtained a 49-year lease and a 49-year right-of-way from the CSLC to construct, operate and maintain the cooling water intake and discharge structures (see Table 3-5).

Table 3-5: Previous CSLC Lease and Right-of-Way for DCPP

Commencement	Lease Premise(s)	Lease	Original Expiration
August 28, 1969	Intake Structure and Intake Breakwaters	Lease No. PRC 4307.1 General Lease -	August 27, 2018
June 1, 1970	Cooling Water Discharge Channel	Lease No. PRC 4449.1 Right of Way	May 31, 2019

The lease and right of way both required PG&E to restore the lease premises, as nearly as possible, to the conditions existing prior to the installation or construction of any improvements when the lease is terminated. Lease No. PRC 4307.1 Section 14 and Lease No. PRC 4449.1 Section 16 stated:

> *That the following specifically enumerated and described structures, buildings, pipe lines, machinery and facilities placed or erected by Lessee or existing and located upon said demised premises shall become and remain the property of the State upon expiration or earlier termination of this agreement; ...*

> *All other structures, buildings, pipe lines, machinery and facilities placed or erected by Lessee or existing and located upon said demised premises shall be salvaged and removed by Lessee, at Lessee's sole expense and risk, within ninety (90) days after the expiration of the period of this agreement or prior to any sooner termination of this agreement; and Lessee in so doing shall restore said demised premises as nearly as possible to the condition existing prior to the erection or placing of the structures, buildings, pipe lines, machinery and facilities so removed…"*

As a result of the Joint Proposal and the decision to retire DCPP, PG&E and the CSLC agreed to replace the old general lease and right-of-way with one new lease that would expire at the same time as DCPP's NRC license for operation of Unit 2. On June 28, 2016, the CSLC authorized termination of the old leases and right-of-way and the execution of a new lease (see Table 3-6).

Table 3-6: Current CSLC Lease for DCPP

Commencement	Lease Premise(s)	Lease	Expiration
June 28, 2016	Discharge Channel, Intake Structure, Intake Breakwaters, and Associated Facilities	Lease No. PRC 9347.1 General Lease - Industrial Use	August 26, 2025

Lease No. PRC 9347.1 defines the Intake Structure, Breakwaters, and Discharge Structure as improvements and retains the obligation to remove all improvements. In recognition of recent developments with respect to decommissioning DCPP, the CSLC agreed to eliminate the time frame for removal of improvements within 90 days after the lease expires. The new lease states the following (Reference 3.1):

> *"Lessee must remove all or any Improvements, together with the debris and all parts of any such Improvements at its sole expense and risk, in accordance with a decommissioning and restoration plan under Section 3, Paragraph I 3(a)(3), regardless of whether Lessee actually constructed or placed the Improvements on the Lease Premises. Lessor may waive all or any part of this obligation in its sole discretion if doing so is in the best interests of the State."*

3.2.3. Breakwater Removal Costs

As the contractual obligation to remove all improvements remains in place, PG&E's site-specific cost estimate was developed to include the costs for the complete removal of the Intake Structure, Breakwaters, and Discharge Structure. The costs associated with the complete removal of the breakwater are summarized in Table 3-7, below, with a more detailed discussion on the removal process in Section 4.1.3.2.4.

Table 3-7: Breakwater Removal Costs

	Labor	Material	Equipment	Disposal	Other	Grand Total
Cost (in thousands)	$18,652	$2,374	$114,526	$18,166	$132,608	$286,326

In addition to the costs in Table 3-7, there are environmental impacts that would be associated with the removal of the breakwater. Removal of the breakwaters would disrupt the well-established existing ecosystem. During the evaluation of demolition techniques required to implement full removal of the Breakwater, it was determined that underwater explosives would need to be used. This would result in significant impacts to local ecosystem, assuming PG&E could obtain the permits to use them at all. To the extent that established wetlands within this area are disturbed or destroyed during removal of the breakwaters, PG&E could be required to mitigate for temporal losses and to re-create permanently lost habitat in a new location. The removal of the breakwater would also have a truck emissions impact from approximately 32,500 truckloads of waste. Because of salt concentration in the breakwater concrete due to years of immersion in the salt water, this concrete material is limited in its allowed reuse due to the potential for corrosive interaction with structural steel (Reference 3.2). The limited allowed reuse would require a recycling company to segregate concrete waste that has been exposed to salt water from clean concrete waste. This makes it unlikely that a recycling company would accept the breakwater's concrete material, meaning it would have to be considered as waste.

It is possible that the concrete from the breakwaters could be reused in non-structural applications to improve existing roads. Potential onsite reuse of the concrete from the breakwaters was evaluated as material for improving the DCPP North Ranch Road, DCPP Primary Access Roads, 500-kV Tower Access roads, and the ISFSI Transporter Route/Reservoir Road. As shown in Table 3-8, approximately 132,321 CY could be reuse on site. However, prior to reuse for road surfacing, the concrete would need to be characterized through sampling and lab analysis to determine the leaching potential for chlorides and pH.

The concrete from the breakwaters could also possibly be reused to fortify the breakwaters at either the Morro Bay Harbor Entrance or at Port San Luis. Per US Army Corps Engineers Shore Protection Manual, Tri-bars and Tetra-pods have been used in conjunction with rubble-mound breakwaters. However, these potential actions also require significant discretionary permitting from agencies outside of PG&E's control.

Due to the low likelihood of a recycling company accepting the breakwater material and the high uncertainty of what percentage of breakwater material may be reused on site, dependent of future salinity testing for potential leaching impacts, and uncertainty of potential offsite marine reuse, the breakwater concrete is classified as debris in this cost estimate. Its waste volume is approximately the same as all the other waste on site combined.

Table 3-8: Potential Onsite Reuse of Breakwater Concrete

Location	Quantity (cubic yards)	Assumptions
DCPP North Access Road	32,000	Add 12-inch layer of pulverized breakwater concrete to the road structural-section design and replace 10-inch aggregate base layer with pulverized breakwater concrete
DCPP South Access Road	31,267	Assumes access road will need to be reconstructed as part of decommissioning. Add 8-inch layer of pulverized concrete to road structural section design
500-kV Tower Access Road - North (on DCPP property)	8,889	Assumes 12-inch later of pulverized concrete can be spread across 16-feet of roadway width for the entire length of the access road
500-kV Tower Access Road - Northeast (on DCPP property)	11,544	Assumes 12-inch later of pulverized concrete can be spread across 16-feet of roadway width for the entire length of the access road
500-kV Tower Access Road - Northeast (within easement)	8,604	Assumes 12-inch later of pulverized concrete can be spread across 16-feet of roadway width for the entire length of the access road
500-kV Tower Access Road - East (on DCCP property)	6,756	Assumes 12-inch later of pulverized concrete can be spread across 16-feet of roadway width for the entire length of the access road
500-kV Tower Access Road - East (within easement)	25,837	Assumes 12-inch later of pulverized concrete can be spread across 16-feet of roadway width for the entire length of the access road
ISFSI - Transporter Route/Reservoir Road	7,425	Substitute pulverized concrete for the imported aggregate base in Reservoir Road section going up to ISFSI. Design calls for 29-inch thick section.

3.2.4. Public Input on Repurposing the Breakwater

There appear to be significant benefits to repurposing the breakwater and PG&E is exploring this option consistent with previous Commission direction.

In the Joint Proposal decision, the Commission directed that "[PG&E] will take no action with respect to any of the lands and facilities, whether owned by the utility or a subsidiary, before completion of a future process including a public stakeholder process; there will be local input and further Commission review prior to the disposition of Diablo Canyon facilities and surrounding lands."[5] In compliance with this order, PG&E has convened an external stakeholder group – the Diablo Canyon Decommissioning Engagement Panel (DCDEP) – in order to engage in open and

[5] D.18-01-22, Ordering Paragraph 13.

transparent dialogue with all interested stakeholders on matters regarding decommissioning and future use of the lands around DCPP.

Public input on repurposing the breakwater is being provided to PG&E through the DCDEP, through public workshops it has held on proposed reuse options, public comments during DCDEP meetings, and emails direct to DCDEP members. It is clear there is significant interest in viable repurposing for the breakwaters. The potential repurposing of the breakwaters would require the asset of the breakwaters to be transferred to another entity and the CSLC would have to transfer the current lease, issue a new lease, or have the legislature transfer ownership to another governmental entity. Specifically, the DCDEP heard testimony from the Port San Luis Harbor District (PSLHD) that it is interested in many of the DCPP assets, including the breakwaters to serve as a marina to support its mission of facilitating coastal access. The PSLHD has hosted its own public meetings to solicit public input and determine viability of operating a marina. The PSLHD has noted that the breakwaters at Diablo Canyon are protected from southern swell events, which its current harbor is exposed to during storms.

At the time of filing, the PSLHD is still exploring and evaluating what this arrangement would look like. However, there have not been any negations to agree upon how to transfer assets, liability and work with the California State Lands Commission or the State Legislature to affect such a transfer. There is not an approved pathway for retaining the breakwaters in effect as of filing. Sections 4.1.1.1.1 and 4.1.3.5.14 discuss the costs associated with implementing the DCDEP pre-shutdown and post-shutdown, respectively.

3.2.5. State Agency Consultation on Breakwater Removal and Repurposing

In compliance with the Commission's directive, PG&E consulted with the following agencies:

- CSLC
- CCC
- California Department of Public Health
- California State Water Resources Control Board
- California Department of Toxic Substance Control

The status of these consultations is addressed in Section 2.4. PG&E will provide periodic progress updates throughout this NDCTP proceeding.

In addition, PG&E will need to evaluate regulatory and permitting requirements to enable the repurposing which may include, but are not limited to, the following jurisdictions:

- CSLC
- CCC
- U.S. Army Corps of Engineers

- National Marine Fisheries Service
- U.S. Fish and Wildlife
- California Division of Fish and Wildlife
- California EPA
- Water Resources Control Board
- San Luis Obispo County

3.2.6. Conclusion

PG&E has identified the costs to remove the breakwaters in compliance with the CSLC lease (see Table 3-6). PG&E will continue to implement the Commission's directive on identifying opportunities for repurposing DCPP's infrastructure, assets, and the final disposition of the land. These repurposing options will require continued consultation and discussion with the jurisdictions, including those listed in Section 3.2.5. While any permit processes and lease arrangements with CSLC may take considerable time and could be costly, these will likely be less impactful to the environment, as discussed in Section 3.2.3, and less impactful to the project schedule and budget as compared with the alternative of removing the breakwaters. It should be noted that repurposing will have costs, which will be presented in future NDCTPs. PG&E will continue to provide updates throughout the proceeding and in future NDCTPs.

3.3. DISPOSAL OF DECOMMISSIONED MATERIAL

Disposal costs are a significant portion of the overall decommissioning cost estimate. Although this cost is driven by the size of the plant radiological controls area (RCA) buildings, contamination levels, and building radiological release strategy, careful management and planning can help control disposal costs.

The cost is based largely on the volume of material generated during decommissioning, including structures, components, concrete, soils, and other debris. Prior to demolition, material slated for removal will be evaluated to identify what can be repurposed (or reused), recycled or disposed of as waste. This approach minimizes costs and is environmentally responsible. Materials designated for reuse will be clean materials that have another use on-site, avoiding transportation and disposal costs. Materials designated for recycling will be clean materials that still possess usable value but are not usable on-site, avoiding transportation and disposal costs. Recyclable materials will be transported to a recycling facility, incurring transportation costs but no disposal costs. Off-site disposal will be considered in cases where neither reuse nor recycling are possible because the material contains radiological or hazardous/regulated contaminants, is not suitable for recycling, or when it is not economical.

Demolition methods and handling techniques will be selected to minimize cross-contaminating clean materials with those required to be disposed of as wastes. To minimize cross-contamination with clean materials, the clean materials will be removed first and segregated from the transportation and storage areas used for radiological or hazardous/regulated materials.

Concrete, for example, was used extensively during DCPP's construction. Most of the non-marine concrete is clean and can be reused at the site for fill, avoiding both transportation and disposal costs. To minimize potential environmental concerns (pH issues) with concrete backfill, PG&E assumes that the concrete will be blended with soil at a rate of 5:1 (soil to concrete). This ratio was approved in a previous San Luis Obispo coastal project. Reuse of concrete was approved by the County of San Luis Obispo in the Chevron/Estero Marine Terminal Source Removal Project. There is more clean concrete than is needed for fill; and the remaining concrete will need to be transported to a recycler. Recycling the excess concrete is more cost effective than disposing of it because only transportation costs are incurred. Last, a small fraction of the concrete slated for removal from the site will exhibit some radiological characteristics that renders the material unsuitable for reuse or recycling. Those materials will be disposed as radiological waste.

Decommissioning materials fall into three basic categories:

Radiological material: Material that contains radioactive contaminants from the operation of DCPP that exceeds established limits. Radiological material must be shipped to an NRC-licensed facility.

Hazardous/regulated materials: Material that contains other regulated substances, such as asbestos, lead, or mercury. Hazardous wastes must be disposed of at a facility designated as a hazardous landfill and are destined to be shipped out-of-state. A subcategory of this waste is "mixed waste," which contains both hazardous and radiological materials. Mixed wastes must be shipped to an NRC-licensed facility and are destined to be shipped out-of-state.

Clean materials: Materials that do not meet the criteria to be classified as radiological, hazardous or mixed wastes. Clean materials may be evaluated for reuse (e.g., concrete for backfill), recycling (e.g., metals such as rebar), or disposal.

In developing the current cost estimate, PG&E has taken substantial steps to minimize the total amount of waste, minimize the amount of high-level waste versus lower-level radiological waste by segregating higher-level wastes, and maximize reusing waste to avoid the costs of off-site disposal.

3.3.1. Waste Reduction through Building Removal Techniques

Over the last three decades, the nuclear industry has adopted several ways to decontaminate nuclear facility buildings and demolish their structural steel and concrete to meet free release criteria, which would allow for disposal at a landfill. The decontamination methods include:

- Mechanical decontamination such as scabbling
- Chemical decontamination to reduce the contaminants to the free release criteria prior to demolition
- Commodity removal to completely remove non-structural, highly contaminated components

By sequencing demolition, meaning to demolish clean buildings first, then contaminated buildings, plants have been able to minimize waste generated and optimize the schedule for removal of the waste. This leads to cost efficiencies and is better for the environment. After removing large or highly contaminated components, most plants have chosen aggressive techniques to remove concrete to lower contamination levels to allow lower cost disposal rather than to spend the time to completely decontaminate the concrete. Contamination in cracks and construction joints was found to require significant time and effort to fully mitigate, adding to overall decommissioning costs. Aggressive techniques include using hydraulic-rams to rapidly remove large thicknesses of concrete instead of taking multiple passes with a concrete shaver (scabbling). (See Section 4.1.3 for detailed information on decontamination methods.)

PG&E has decided to use a combination of all three methods, based on input from industry experts, to prepare for Open Air Demolition (OAD), which is the fastest and most cost-effective way to demolish large buildings in preparation for dispositioning the resultant materials. Prior to OAD, the structures will be evaluated to quantify both radiological and hazardous/regulated materials contained inside. Limits for each type of hazard will be developed to ensure the continued protection of the workforce, public, and environment during OAD. The buildings will then be separated into different categories to ensure that the waste is segregated properly. Clean concrete will be used for backfill, if appropriate; all other materials will be recycled or disposed of in an appropriate landfill.

In buildings with contaminated systems/areas, the highly contaminated systems or large components will be removed first, then they will be decontaminated or sealed in place. Examples of a large contaminated component are the SGs or reactor coolant pumps (RCPs). If any hazard exceeds the limit, then the hazard is further mitigated prior to OAD. Residual concrete surfaces of impacted structures would be decontaminated by using an abrasive, or scabbling would be used to lower contamination levels in these areas. Similarly, residual structural steel surfaces of impacted structures will be decontaminated to a bare bright finish by abrasive blasting or mechanical abrading. Once all hazards are below the established limits, OAD can proceed. This method minimizes cross-contamination of other areas when a building is demolished, which would potentially increase disposal costs. The building and remaining components will be demolished at the same time. The resultant demolition material will then be loaded and transported to a waste or recycling center as appropriate. Clean material will be kept segregated from radiological and hazardous/regulated material to prevent cross contamination that would result in cost increases with disposal.

PG&E has preliminarily identified all buildings on site and initially categorized them into these categories:

- Category 1: Structures that require little or no decontamination or hazardous material removal
- Category 2: Structures that require significant amounts of preparation
- Category 3: Large structures that are unique and require significant amounts of preparation

<u>Categories 1 and 2</u>

During OAD, Category 1 and 2 structures will first be demolished down to each structure's floor slab elevation. During this period, the Demolition Group (DG) will segregate the demolition debris to the greatest extent practicable. Clean concrete rubble from demolition will be used as backfill and other uses on site to the extent possible. To minimize potential environmental concerns (pH issues) with concrete backfill, PG&E assumes that the concrete will be blended with soil at a rate of 5:1 (soil to concrete). Reuse of concrete was approved by the San Luis Obispo County in the Chevron/Estero Marine Terminal Source Removal Project. However, PG&E expects there will be more clean concrete generated from decommissioning activities than the site can use for backfill. This excess debris will be transported to the Pismo Beach Railyard. Contaminated debris will be sent to an area designated by the Waste Operations Group (WOG) for packaging and required documentation.

The subsequent removal of the remaining Category 1 and 2 structures will occur once the FSS Plan has been developed by the Final Site Restoration Group and any required surveys conducted.

Category 3

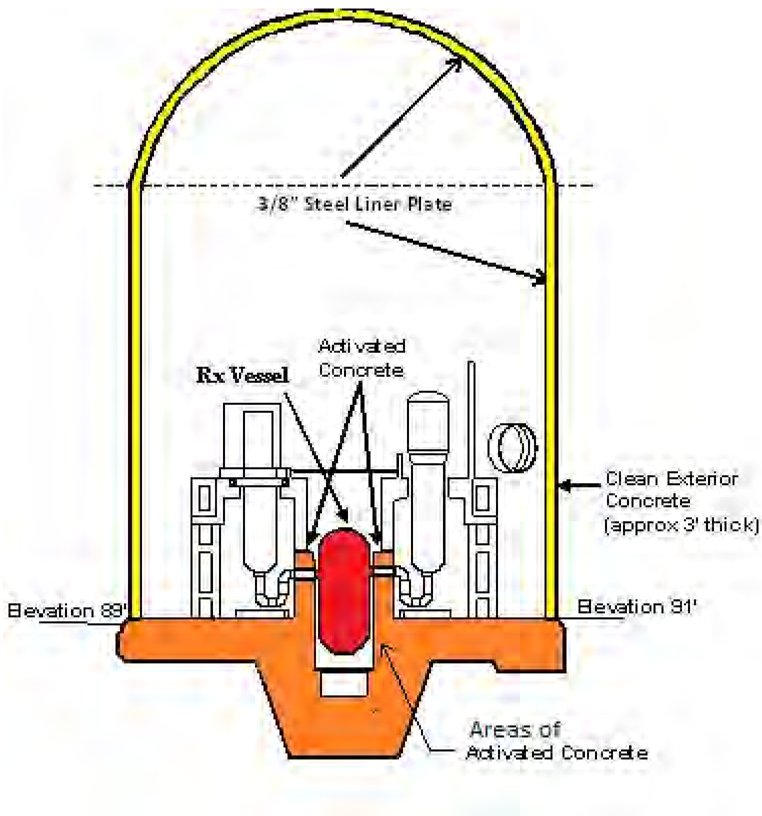
The Intake Structure is large and unique. It will be demolished when it is no longer needed for site operations. As is the case with the disposal of the breakwater's concrete discussion above, this material will not be reused or recycled due to its salt content from years of contact with the ocean.

The demolition of the Containment Buildings, Turbine Building, and Auxiliary Building, which include the Fuel Handling Buildings and the Discharge Structure, will begin after all the spent fuel, special nuclear materials, and GTCC waste have been transferred to the ISFSI.

The Containment Buildings at the DCPP's site are unique in that they are not occupied during the plant's operation. The buildings are typically only accessed when the plant is shut down for periods such as refueling outages every 18 months. During operations, some containment surfaces may become contaminated due to minor amounts of system leakage. When the plant is shut down for an outage, the accessible surfaces are decontaminated. Certain parts of the structures' interiors have limited accessibility or small concrete cracks below the surface that remain radiologically contaminated. The containment building exteriors are not expected to be contaminated because they have a steel liner plate that serves as a barrier -- preventing contamination that's on the interior surfaces from migrating into the buildings' outer shell. These liners will be left in place until the interior is demolished to prevent contamination of the exterior shell. The liners will then be decontaminated. With this sequence the exterior dome of containment is expected to remain clean material and be available for repurposing on site (See Figure 3-8).

The concrete and steel around the RPV is expected to be activated from years of power operations. The activation comes from years of neutron exposure with the concrete around the RPV while it is producing power. Activated concrete cannot be decontaminated, and therefore, is radiological material. The activation of the concrete around the RPV and years of work in containment make the interior of containment concrete a waste that cannot be reused or recycled.

Figure 3-8: Containment



3.3.2. Disposal of Material

An overall goal of DCPP decommissioning is to reduce the amount of material that is disposed of in a landfill/burial facility and is environmentally responsible. PG&E has evaluated the site and detailed the types and quantities of each material on site to determine the lowest cost option, including what quantities of material could be recycled or reused onsite instead of shipped offsite for disposal. PG&E determined the estimated cost of disposal based on the type and amount of material, disposal location, and transportation method.

Several transportation methods were evaluated – including trucking, barge, and rail. PG&E determined that it is cost effective to use a combination of trucks and rail. Some disposal or recycling centers cannot receive rail cars, therefore in these cases, trucking was selected. Rail was the preferred option for radiological waste because the disposal sites that can receive this waste have rail spurs; this option also reduces the impacts to roads and the environment due to lower emissions. While work boats and barges could be used during DCPP decommissioning to assist in the removal of the intake and discharge structures, east and west breakwaters, and to transport waste materials from the project site to ports in either Southern or Northern California their use presents additional regulatory, operational, and cost challenges.

In review of state regulations and mitigation measures from the SONGS draft EIR, the use of work boats and barges would present several challenges for the DCPP decommissioning project. The SONGS draft EIR proposes as a mitigation measure that all barges and work boats to be used during the SONGS decommissioning project originate from ports located within California. The restriction of marine vessels to specific harbors reduces the likelihood of vehicle availability and is potentially cost-prohibitive as there are a limited number of marine work vessels in California.

Additionally, while the SONGS draft EIR proposes extensive mitigation measures to limit the spread of non-native marine species, the DCPP coastline has been touted by many as pristine and virtually untouched and is not exposed to such risks today. The use of work boats and barges from local ports still has the potential to introduce invasive marine species into this pristine environment. The introduction of non-native marine species can result in permanent changes to the coastal environment and marine community; several local groups have expressed explicit interest in preserving this area and introducing this risk does not result in favorable tradeoffs for operations or other considerations.

The use of barges to transport waste materials offsite present two additional challenges not easily overcome: greenhouse gas emissions from barges during transport of waste to a nearby port and the potential for waste to be discharged to the ocean during an accident. The use of marine barges for transport of waste from DCPP to a local port (likely Port Hueneme) would result in a significant increase of air emissions, as the trip would be over approximately 125 nautical miles vs. the nearby rail spur in Pismo Beach, CA. The SONGS decommissioning project will not be using barges for waste transport, even with several local ports available with significantly shorter travel distances.

Finally, the costs to retrieve any waste discharged into the ocean during an accident would likely be significant, if even technically feasible, with both the risks and costs outweighing any potential costs savings versus hauling waste offsite by truck.

Further details can be found in Section 4.1.1.7.

Methods for transporting and disposing of waste materials generated during RPV and internals segmentation, and removal of select large components, were evaluated individually due to the radionuclide concentrations and inordinate size of the materials. The methods chosen for disposition of these waste materials are discussed in Sections 4.1.1.4 and 4.1.1.6, respectively. As discussed within Sections 4.1.1.4 and 4.1.1.6, the costs for transportation and disposal associated with these unique waste materials were estimated within these specific scopes of work.

3.3.2.1. Radiological Material

There are five types of radioactive waste listed below in ascending order of contamination and unit disposal costs:

Low-Activity Radioactive Waste (LARW): This material exhibits minimal detectable activity, where the level does not cross the lower threshold of Class A waste definition parameters; it will be disposed of as

10 CFR 20.2002 waste. Although 10 CFR 20.2002 waste is radioactive waste, it is not low-level radioactive waste (LLRW).

Class A: This material's radiological activity concentration is easily detectable and does not exceed 0.1 times the value in Table 1 of 10 CFR 61.55.

Class B: This material must meet more rigorous requirements, as set forth in 10 CFR 61.56. The physical form and characteristics of Class B waste must meet both the minimum and stability requirements.

Class C: This material has increasing levels of activity as compared to Class A; it exceeds 0.1 times the value in Table 1 of 10 CFR 61.55 but does not exceed the values in Table 1; it not only must meet more rigorous requirements on waste form to ensure stability, but it also requires additional measures at the disposal facility to protect against inadvertent intrusion. The physical form and characteristics of Class C waste must meet both the minimum and stability requirements set forth in 10 CFR 61.56.

GTCC: This material's radiological activity concentration exceeds the value in Table 1 in 10 CFR 61.55; the waste is not generally acceptable for near-surface disposal; it is managed the same as high-level radioactive waste. There are no licensed facilities that can accept GTCC waste, and, therefore, will be stored in the ISFSI. The generation and packaging of GTCC waste is discussed in Section 4.1.1.4.

Currently, there are three licensed facilities that can accept DCPP radiological material for disposal in the United States: Clive Disposal Facility in Clive, Utah; Waste Control Specialists LLC in Andrews, Texas and US Ecology in Grand View, Idaho. Each of these facilities can receive different types of radiological materials. To the extent practical, PG&E will minimize the generation of Class B/C waste in order to avoid the high cost of disposing it. Further, much of the material that is potentially contaminated is expected to have very low radiological contamination, below Class A, known as LARW. The Idaho facility is currently the most cost-effective facility available to DCPP and licensed to accept LARW waste. PG&E will attempt to segregate LARW material from material that meets the Class A criteria because it can be disposed of at nearly one-fifth the cost of Class A waste. PG&E estimates that there will be approximately 60 percent more LARW waste than all of the Class A waste. Taking into account the different disposal locations and costs, disposing of waste classified as LARW is approximately 75 percent less expensive than disposing of that same waste if it were classified as Class A waste. Segregation activities and proper classification of the waste would result in a cost avoidance of approximately $470 million. The costs of the various disposal options are depicted in Table 3-9.

There are no facilities in the United States that can receive GTCC wastes. The GTCC wastes will be packaged in containers similar to those used for packaging of SNF in order to provide for safe on-site storage and to ensure that the material is isolated from the environment. Ultimately, PG&E believes the GTCC wastes will be transferred to DOE or some other federally licensed final repository.

3.3.2.2. Hazardous Material (Excluding Mixed Waste)

The most common hazardous materials include asbestos, lead, mercury, and polychlorinated biphenyls (PCBs). Suitable disposal locations were identified for the cost estimate. For detailed cost information see Section 4.1.1.3. The cost of material disposal is depicted in Table 3-9.

Table 3-9: Materials Disposal Costs

Type of Waste	Waste Volumes (tons)	Waste Volumes (ft^3)	Preferred Disposal/Recycle Facility	Chosen Transportation Option	Transportation Cost	Disposal Cost	Total T & D Cost
			Clean Waste				
Non-Rad Disposal (including BW)	794,000	9,925,004	[redacted]	IMC Tipper to Gondola	[redacted]	[redacted]	[redacted]
Non-Rad Metal Recycle	72,281	803,123	[redacted]	IMC on Railcar	[redacted]	[redacted]	[redacted]
Non-Rad Concrete Recycle	87,887	1,098,584	[redacted]	Direct Truck	[redacted]	[redacted]	[redacted]
				Non-Rad Subtotal	[redacted]	[redacted]	[redacted]
			Radiological and Regulated Waste				
Other Regulated Waste	34,263	856,572	[redacted]	Direct Truck	[redacted]	[redacted]	[redacted]
LARW (20.2002)	231,385	5,019,379	[redacted]	IMC Tipper to Gondola	[redacted]	[redacted]	[redacted]
Licensed Class A	129,910	2,885,408	[redacted]	Combination	[redacted]	[redacted]	[redacted]
Class B/C	[redacted]	[redacted]	[redacted]	Direct Truck	[redacted]	[redacted]	[redacted]
GTCC Wastes	[redacted]	[redacted]	[redacted]	On-Site Storage	[redacted]	[redacted]	[redacted]
Large Component Class A	7,760	174,326	[redacted]	Direct Truck/ Specialty	[redacted]	[redacted]	[redacted]
RPV/RVI Activities			[redacted]	Combination Rail/ Truck	[redacted]	[redacted]	[redacted]
Class A (Containerized and bulk)	1,735	87,460	[redacted]		[redacted]	[redacted]	[redacted]
Class B	206	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]
Class C	105	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]
				Rad and Reg. Subtotal	[redacted]	[redacted]	[redacted]
				Grand Totals	[redacted]	[redacted]	[redacted]

3.3.2.3. Clean Material

Clean Material is non-radiological/non-hazardous material that falls into one of three categories:

1.) Reusable concrete material
2.) Recyclable materials, which include two primary categories:
    A. Concrete
    B. Metals, both ferrous and non-ferrous
3.) General demolition debris

PG&E plans to disposition clean materials by one of the following methods:

Reuse

A significant portion of the clean concrete rubble will be reused on site. The material will be crushed and screened on-site by the Materials Management Group (MMG) and then used as backfill during the final site restoration phase. All clean concrete rubble in excess of the required backfill quantity will be shipped off-site as recycled material to avoid disposal costs. Reuse material will be blended with soil as described above. This reuse equates to approximately [redacted] in avoided transportation costs to the nearest out-of-state concrete recycling facility. Additionally, reuse of material onsite eliminates [redacted] truck trips from the site.

Recycle

By recycling clean waste, selling certain items for reuse or to a recycling center, PG&E reduces disposal fees and the environmental impact of decommissioning. The current assumption for determining the cost of recycling non-radioactive material includes utilizing a truck to transport the items. The recycling centers are out of state in Nevada or Utah. Non-radiological metallic materials, ferrous and non-ferrous, will be sold to a metal recycler that will provide the metallic materials to an end user. The local and regional recycling companies function as brokers, processing and/or sizing the material before moving the scrap to larger companies, which in-turn typically move the scrap to international locations through the Ports of Oakland or Long Beach in California. (See Section 4.1.1.8 for further discussions on material management.)

Every company or broker involved in the metal scrap chain between the site and the recycling endpoint further depletes the scrap value because of compounded costs for their handling, transport further down the line and profit. For example, steel sold to a local buyer that ends up in Asia would have appreciable hidden cost buried in the gross steel value offered by the local scrap (e.g., brokering) dealer. For this reason, PG&E has determined that the most economical approach to moving metal scrap is to sell and transport it directly to the end buyer. Salt Lake City has the closest large recycler of steel. There currently are no large steel recyclers in California. Steel is about 10 percent of the overall waste material on site.

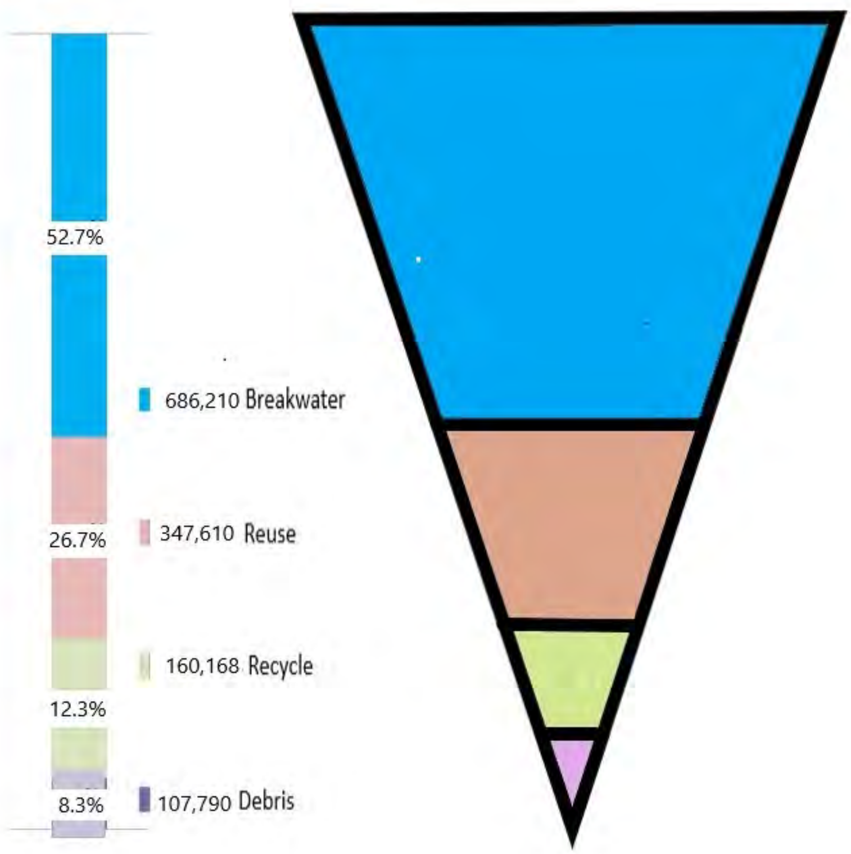
Concrete that cannot be reused on site will be trucked to a recycler in Las Vegas. This is the closest large recycling facility for concrete that can support the volume of concrete that will be recycled.

Disposal

Clean general debris that is not suitable for reuse and recycling (e.g., drywall, ceiling tile and wood) will be shipped to a landfill in La Paz, Arizona, which is determined to be the most appropriate location because of its proximity to the DCPP site and that it can take the general debris via rail.

The relative volumes of clean wastes are depicted in Figure 3-9.

Figure 3-9: Clean Material Disposition (in Tons)



3.3.3. California Executive Order D-62-02

Disposal of nuclear decommissioning waste within California with radiological levels below those that are covered by NRC regulations has been a contentious issue for several decades.

In September 2002, then-governor Davis issued California Executive Order D-62-02 in response to SB 1970. The governor vetoed the bill and wrote:

> *"This bill redefines the term 'radioactive waste' to include any discarded decommissioned material with the slightest trace of detectable radioactivity not attributable to background sources, and prohibits all*

> *such material from being disposed of at all existing hazardous or solid waste disposal facilities in the State of California*."

After vetoing SB 1970, the governor issued Executive Order D-62-02 which states the Department of Health Services (DHS) has been directed by court order to conduct a CEQA review:

> *"…including an assessment of the public health and environmental safety risks and the threat to California's ground and drinking water associated with disposal of decommissioned material."*

The Executive Order directed DHS to promulgate regulations for the disposal of "decommissioned materials" at California licensed sites. It defined decommissioned materials as:

> *"…materials with low residual levels of radioactivity that, upon decommissioning of a licensed site, may presently be released with no restrictions upon their use…"*

The Executive Order also directed the State Water Resources Control Board and the Regional Water Quality Control Boards (Water Boards) to impose a moratorium on disposal of decommissioned materials into Class III landfills and unclassified waste management units. The moratorium is to remain in place until the DHS completes its assessment of the public health and environmental safety risks associated with the disposal of decommissioned materials and adopts regulations setting dose standards.

In testimony on March 7, 2003, when asked where facilities should dispose of decommissioned materials, Dr. Diana Bonta, director of the DHS, testified that "…facilities can certainly remove the [decommissioned] materials to a licensed, low-level radioactive site which would be out of state." She further testified that DHS would be completing a CEQA review and determining what should be the proper level for disposal in a safe fashion. Her testimony provided no guidance on safe levels for disposal and left open the possibility of a complete prohibition on decommissioned material being placed in a landfill in California (Reference 3.21).

DHS was reorganized in 2007, creating the Department of Health Care Services (DHCS) and the CDPH. Neither department has begun the CEQA review and regulatory actions required by the Executive Order, and the moratorium remains in place.

For many years the Commission has accepted nuclear decommissioning cost estimates that conclude that the Executive Order requires that decommissioned material must be disposed of out-of-state. However, in the 2015 NDCTP, the Commission directed PG&E to consult with various state agencies as to "the application of Executive Order D-62-02 to decommissioned material at DCPP" (Reference 3.3). PG&E's consultation with these agencies is discussed in Section 2.4.

It would never be appropriate for decommissioned material to be disposed of in a Class III facility, which is a municipal landfill that is not authorized to accept hazardous waste. There are four Class I disposal facilities and eight Class II disposal facilities holding active licenses in California. Two of the Class II facilities accept only waste from within their county. This leaves four Class I and six Class II facilities as possible disposal options. PG&E contacted several sites that stated they would only accept decommissioned material if PG&E obtained a letter from the applicable regulatory agency giving approval to accept the material.

For reference purposes, PG&E estimated the cost differential if PG&E were able to dispose of this material in state. To be clear, PG&E does not believe in-state facilities will accept this material without state regulatory action. In order to compare hypothetical in-state vs. out-of-state costs for recycling and for debris disposal, PG&E used a uniform disposal rate based on published information for both in-state and out-of-state disposal. Therefore, the only difference in cost would be for transportation. In-state transportation is assumed to be by truck while out-of-state transportation is by rail or truck, depending on the amount to transport. The difference in costs between out-of-state vs. in-state disposal was calculated by subtracting in-state from out-of-state transportation costs. This calculation (see Table 3-10) identified a total transportation cost difference of approximately $10.37 million for non-breakwater debris and recycling, and a total of $87.86 million with the breakwater debris included.

Table 3-10: In-State/Out-of-State Transportation Comparison

Transport Destination/ Method	General Debris	General Debris plus Breakwater	Recycle Concrete	
In-State	$6.00M (Truck)	$44.19M (Truck)	$4.89M (Truck)	
Out-of-State	$12.52M (Truck)	$128.2M (Rail)	$8.74M (Truck)	
Difference (Out-of-State minus In-State)	$6.52M	$84.01M	$3.85M	
Total Difference (Out-of-State minus In-State) Without Breakwater				**$10.37M**
Total Difference (Out-of-State minus In-State) With Breakwater				**$87.86M**

In addition to the fact that the state of California has yet to establish clear guidelines regarding in-state disposal of decommissioned materials, it's reasonable to assume that not all in-state facilities are able or willing to receive the projected waste volumes. By contrast, the disposal facilities that PG&E anticipates using for this effort all have projected continued operation and available capacity for at least 30 years, sufficient to complete the planned decommissioning. Given these circumstances, PG&E's assumption that this material will be disposed of at the disposal site in La Paz, Arizona, is reasonable. This facility is also being utilized for the SONGS decommissioning project.

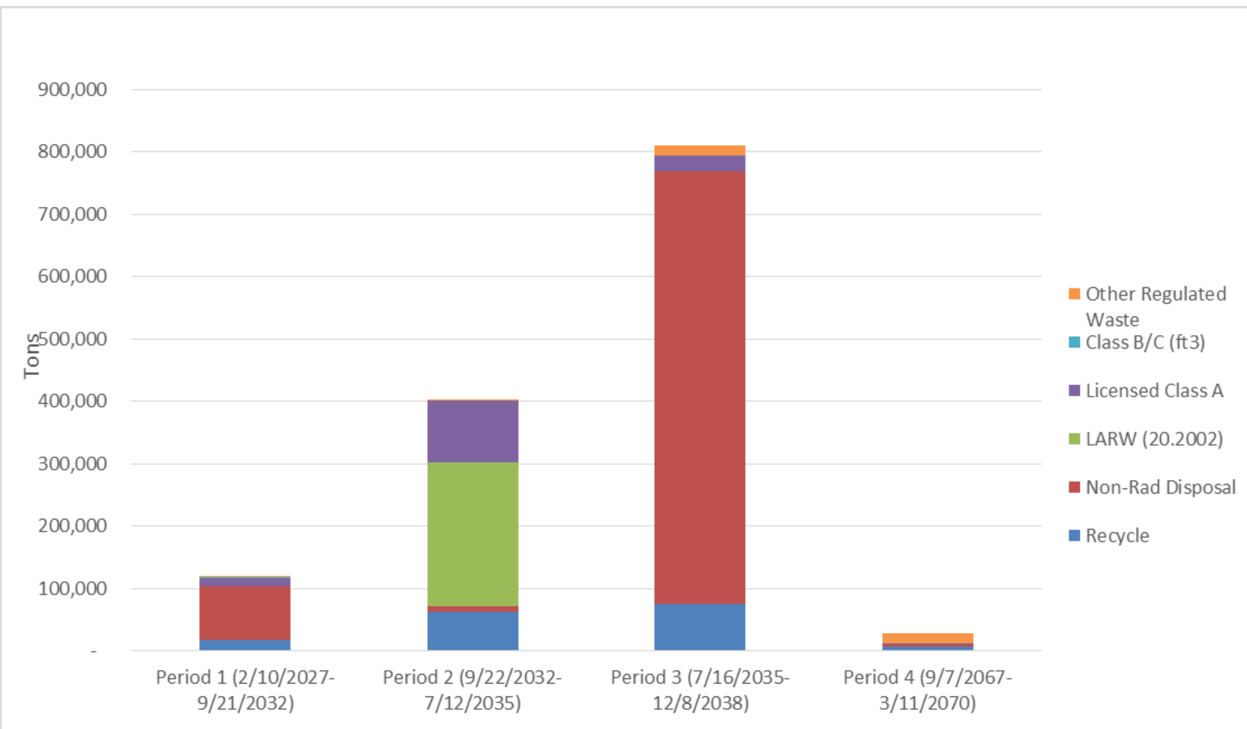
3.3.4. Summary

PG&E is proactively managing the generation of decommissioning materials that require disposition. PG&E's goal is that clean materials stay clean and identifying all reasonable opportunities to: (1) reuse clean materials, avoiding both transportation and disposal costs; (2) recycle clean materials when reuse is not a viable option, avoiding disposal costs; and (3) when reuse and recycle of clean materials is not an option, to seek the lowest cost transportation and disposal options available.

In addition to managing clean materials, PG&E has a strategy to minimize the costs of disposing of radiological materials. Since the least expensive radiological materials to dispose of are those materials containing the lowest radiological activity concentrations, PG&E will minimize the higher activity Class B/C wastes and segregate LARW from Class A wastes to the maximum extent possible.

Waste volumes are depicted in Figure 3-10 with the breakwater volumes included.

Figure 3-10: Waste Volume Shipments (By Time Period) Including the Breakwater



3.4. SECURITY

3.4.1. Summary

The DCPP security cost estimate includes costs for implementing proposed security modifications and security staffing between permanent shutdown and transfer of spent fuel and GTCC to an approved, off-site facility. Engineering, procurement, and construction costs for a new ISFSI security building are described in Section 4.1.1.2.2.

In previous NDCTP's, the Commission has expressed concerns about the basis for PG&E's determination of post-operational security staffing costs. For purposes of preparing a new estimate, PG&E first reviewed NRC requirements and PG&E's existing staffing. In order to meet PG&E's existing NRC mandated security obligations, PG&E required 272 security FTEs. PG&E then evaluated security risks and vulnerabilities from the time the first unit is shut down through decommissioning. PG&E used a widely accepted commercial 3D modeling and statistical analysis program to determine vulnerabilities, and the number of posts, or positions which must be staffed in order to protect the target areas. Once posts were determined, to ensure adequate staffing PG&E determined the number of FTEs required to fill each post. Additionally, PG&E proactively evaluated steps which could be undertaken prior to each phase of decommissioning to obtain regulatory approvals to reduce the number of required posts.

3.4.2. PG&E Compliance with NRC Security Regulations

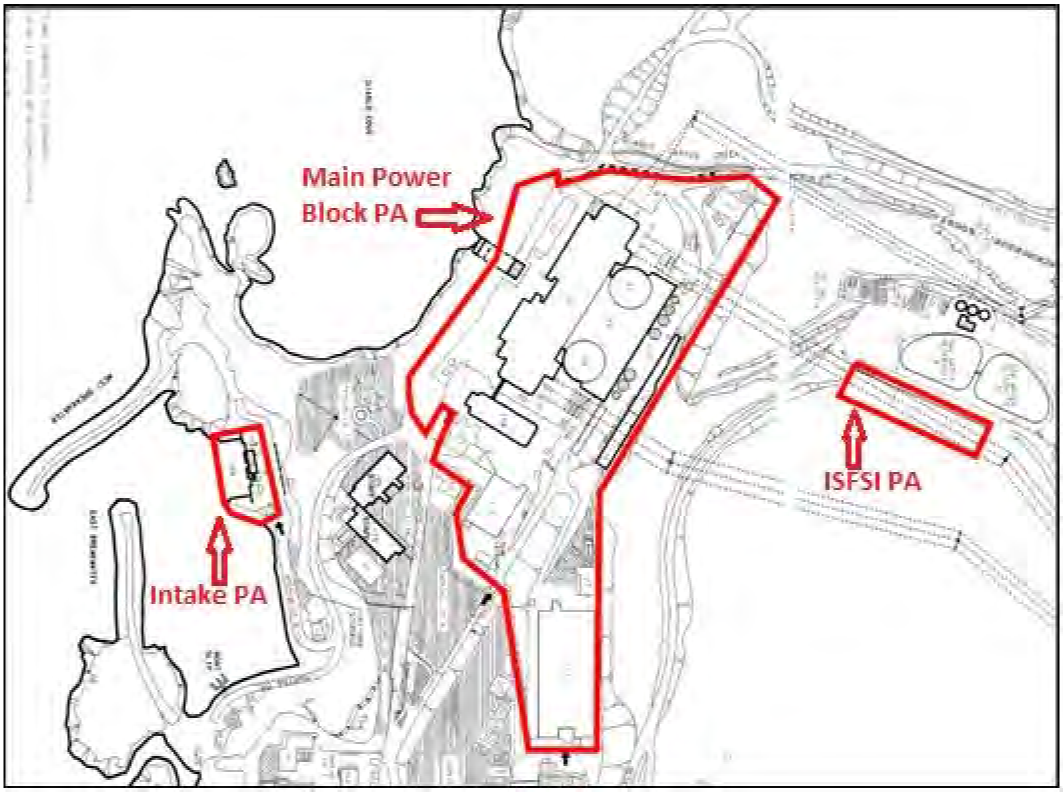
Whether the plant is operating or not, NRC regulations in 10 CFR 73.55 require PG&E to establish and maintain the capability to detect, assess, interdict, and neutralize security threats. The regulations also require a "defense in depth" approach to demonstrate the continuous effectiveness of the security program. Defense in depth is the use of multiple and diverse security measures to protect the DCPP site. In addition, PG&E must establish, maintain, and implement an NRC-approved Physical Security Plan, Training and Qualification Plan and Safeguards Contingency Plan, including amendments. PG&E is also required to control personnel access to areas that do not contain special nuclear material but may contain significant quantities of radioactive materials that could be used for nefarious purposes.

After the events of September 11, 2001, the NRC has required a series of additional security measures, including increased patrols, augmented security forces and capabilities and more restrictive site access controls. These NRC requirements are contained in 10 CFR 73, various NRC orders and guidance documents and have been incorporated in PG&E's NRC-approved security plans.

PG&E also holds an ISFSI 10 CFR 72 site-specific license, which is separate from the reactor unit licenses. Security requirements for a licensee that holds a specific ISFSI license are contained in 10 CFR 73.51 and are generally less stringent than those for a reactor because of the reduced risks associated with ISFSI operations. In lieu of maintaining separate security programs for the DCPP reactor units and the ISFSI, PG&E maintains a single security program compliant with 10 CFR 73.55 for DCPP Unit 1, Unit 2 and ISFSI.

There are three PA locations within the site boundary, as shown in Figure 1-2. These areas consist of the main power block PA, intake PA, and ISFSI PA. Within these areas, DCPP maintains a physical protection system and security personnel to protect identified vital equipment and structures against radiological sabotage, to prevent the theft or diversion of special nuclear material and to provide adequate protection of public health and safety from any security event described in the Site Emergency Plan.

Figure 3-11: DCPP Protected Area Locations



The DCPP Protective Strategy, in conjunction with the Physical Security Plan, Training and Qualification Plan and Safeguards Contingency Plan, were implemented to comply with 10 CFR 73.55 security requirements and have been approved by the NRC.

The DCPP Protective Strategy describes the detailed response types, timelines, and situational information necessary for DCPP security personnel to successfully interdict and neutralize a design basis threat. The DCPP Protective Strategy identifies the internal and external security measures necessary to protect against acts of radiological sabotage, prevent the theft or diversion of special nuclear material and to provide adequate protection of public health and safety. Multiple threats and possible risk scenarios for various vital equipment and structures within the onsite PAs are addressed as part of the protective strategy.

The Physical Security Plan describes the physical protection system and security personnel protecting the DCPP site against radiological sabotage and preventing the theft of special nuclear material.

The Safeguards Contingency Plan describes actions that will be taken to protect the DCPP site against radiological sabotage and to prevent the theft of special nuclear material.

The Security Training and Qualification Plan ensures that security personnel are trained, qualified, and equipped to perform their assigned duties as identified in the protective strategy and security plans.

Security personnel are also responsible for administrative and programmatic controls (e.g., criminal history, background checks, Fitness for Duty Program, Behavior Observation Program, and Insider Mitigation Program) that are required by the NRC to ensure the physical fitness and trustworthiness of security personnel and other critical employees.

Security at DCPP is in place 24 hours a day, seven days a week. To implement NRC requirements, the combined pre-shutdown security staffing level at DCPP Unit 1, Unit 2 and ISFSI is 272 FTEs. The 272 FTEs include security posts, management, and support staff. Support staff includes access authorization, training, fitness for duty and other staff required to procure security-related equipment and protect safeguard information.

It should be noted that the NRC routinely conducts security inspection activities to ensure that the DCPP security program complies with 10 CFR 73.55 and is effectively implemented to protect public health and safety. In addition, the NRC conducts Force-on-Force drills to test PG&E's capability to detect and neutralize potential threats. During an NRC 2010 security inspection at DCPP, the NRC identified several security-related deficiencies; and to restore compliance, DCPP was required to install additional security equipment, and acquire supplemental security staff. While Units 1 and 2 are operating, the current level of staffing is required to ensure compliance with 10 CFR 73.55, various NRC orders and NRC guidance documents.

3.4.3. Preparation of Decommissioning Security Cost Estimate

3.4.3.1. Preliminary Planning

PG&E began estimating decommissioning security costs by evaluating security risks and vulnerabilities during decommissioning. Security-related plant modifications were also identified to mitigate or eliminate potential risks and exposures, optimize security operations, and reduce security costs. Based on several factors including risks of unintended openings, cost, duration in wet storage and benchmarking of plants entering active decommissioning, PG&E determined that the existing protective area fence lines should remain unchanged. Security staffing levels were projected between permanent shutdown and transfer of spent fuel and GTCC waste to DOE.

An adversary's mission is to attempt radiological sabotage by disrupting plant operations or destroying plant equipment within the security perimeter. The security perimeter fence is the best location to defend against a potential adversary. An adversary's chance of success increases if the security perimeter is located close to or inside onsite buildings or structures.

To develop a post shutdown protective strategy, PG&E used a commercial 3D modeling and statistical analysis. The AVERT Software by ARES Corp. results can be used to identify vulnerabilities and reduce the number of required performance-based drills and exercises to establish an optimal defensive strategy by determining ideal locations for security positions and barriers, and permitting validation by modeling removing posts until security breaking point. The AVERT software has been used to assess potential security vulnerabilities at the DOE, U.S. Department of Defense (DOD), and several commercial nuclear power plants. It is an NRC-recognized tool for performing security vulnerability assessments and is actively used by several NRC licensees to identify cost reduction measures in security operations.

PG&E used the AVERT Software to model the DCPP site interior and exterior features and access points and simulate multiple security threat types. Various security configurations and scenarios were performed to identify potential vulnerabilities and areas where security operations can be potentially optimized. PG&E evaluated simulations to confirm the adequacy of the current security strategy and security posts, as well as those that will be set up between the times Units 1 and 2 are shut down and spent fuel is transferred to an approved off-site facility. Performance-based drills will be performed after implementation of security modifications to further refine the defensive strategy during decommissioning.

To validate the results, additional simulations were performed to sequentially remove security posts to identify the point where high assurance to protect against radiological sabotage would no longer be maintained. The validation simulations identified a sharp decline in the defensive capabilities after the removal of two security posts. Therefore, PG&E concluded that that the validation simulation results confirms that the defensive strategy after permanent shutdown demonstrates high assurance that adequate protection will be provided against radiological sabotage as required in 10 CFR 73.

In addition, the results were used to determine: (1) the reasonableness of several security modifications that could optimize security operations and reduce overall security costs; and (2) the best time to implement changes to the physical security system, obtain regulatory relief and reduce security staffing levels during decommissioning.

3.4.3.2. Independent Review of Decommissioning Security Approach

PG&E hired industry expert G4S Regulated Security Solutions Special Tactical Services (STS) to independently review PG&E's security plan. The subject matter expert at STS has conducted protective strategy reviews at numerous nuclear facilities; helped adjust strategies after identifying efficiencies and margin; designed extensive barrier plans; provided on-site consultation about all aspects of the NRC's triennial Force on Force program; conducted exploitability analysis for unattended openings and safeguards violations; and supported the development and use of the AVERT system for nuclear-specific design basis threat adversary and security force response.

STS conducted an in-depth analysis by performing site inspections and tabletop exercises to assess the reasonableness of PG&E's application of the AVERT software, proposed security modifications, number of security posts and the overall defensive strategy. The report (Reference 3.20) concluded that:

1) PG&E's decommissioning defensive strategy is well thought out and is reasonable

2) The use of the AVERT 3D modeling and statistical analysis results is a reasonable approach to identify the security staffing needed to successfully protect the plant during decommissioning and storage of fuel at the ISFSI
3) Based on the AVERT results, PG&E has identified the most efficient strategy while maintaining a high assurance to provide protection against radiological sabotage
4) PG&E has identified the necessary number of security posts to ensure protection of the plant in accordance with the 10 CFR 73.55 security requirements; The number will initially increase and then decrease over subsequent periods. STS noted that PG&E was attempting to avoid a costly mistake made by other decommissioning sites – reducing too many security personnel, then having to hire additional security staff later at greater cost.

STS also analyzed PG&E's proposed security modifications. To reduce security posts, PG&E originally planned to reconfigure the main PA fencing so that the main warehouse is located outside the main PA. The independent review concluded that doing so would have a limited cost benefit. As a result, PG&E determined that it would not be cost effective to implement the main PA modification and eliminated it from further consideration. STS concluded that the remaining proposed security modifications would improve security response times, reduce the number of interior response positions, and reduce the likelihood of an adversary gaining access to a target set location.

3.4.4. Phased Strategy for Security

The primary security cost is staffing. In order to reduce staffing costs, PG&E has determined that, with NRC concurrence, security staffing may be based on four decommissioning periods (Periods 0, 1, 2 and 3). Periods 1, 2 and 3 align with NRC-identified decommissioning milestones in decommissioning guidance documents. PG&E added a fourth period (Period 0) to reflect the ramp-up of security-related decommissioning planning activities (e.g., preparation and submittal of NRC exemptions, license amendments) and security staffing prior to the shutdown of the second unit. The NRC Levels and DCPP comparable periods are:

- Period 0: One unit is shutdown and defueled with one unit operational. The duration of Period 0 is approximately ten months.
- Period 1: Both units are shut down, defueled, and spent fuel is stored in the SFPs. However, the spent fuel has not sufficiently cooled such that the probability of a zirc-fire accident is very low. The duration of Period 1 is approximately 18 months.
- Period 2: Spent fuel is stored in the SFPs and has sufficiently cooled such that the probability of a zirc-fire accident is very low. The duration of Period 2 is approximately 5.5 years.
- Period 3: All spent fuel is stored at the ISFSI. Based on PG&E's current assumptions about DOE pickup of spent fuel, the duration of Period 3 is approximately 35 years.

During each decommissioning period, the security protective strategy will be adjusted as required to reflect the security staffing necessary to protect the site. PG&E performed a series of reviews and analyses to:

- Assess the impact of reducing the number of vital equipment and structures and determine the resulting increase or decrease in security costs to implement compensatory measures (e.g., additional posts);
- Identify security modifications that most likely would reduce security posts and create more efficient security operations.
- Identify potential NRC regulatory relief that should be sought during decommissioning. Regulatory relief consists of NRC exemption requests from security regulations, license amendment requests to modify security licensing basis documents, and requests to rescind NRC security-related orders that no longer apply to a permanently shutdown facility.

The results were used to identify the best time to implement security modifications, obtain regulatory relief and reduce security staffing levels during the decommissioning periods. As security risks and vulnerabilities decrease, security staffing levels will gradually decline.

To the extent practical, early implementation of security-related modifications is planned after permanent shutdown of the first reactor unit to optimize security operations, prepare the DCPP site for decommissioning of both reactor units and minimize the net increase in security staffing. A detailed description of each modification is in Section 4.1.1.2.3.

In addition, based on previously granted NRC security-related decommissioning exemptions, PG&E concluded that the largest reductions in security staffing may occur at the end of the zirc fire window (Period 1) driven by the implementation of security modifications; after devitalization of the control room (Period 2); and upon the transition from a 10 CFR 73.55 to a 10 CFR 73.51 security program (Period 3). As such, regulatory exemption requests are planned during the decommissioning periods associated with these milestones. To minimize potential delays in implementing security staffing reductions, the goal is to submit requested regulatory relief to the NRC at least 18 months in advance to ensure that the NRC has sufficient time to review and approve the request prior to the scheduled implementation date of the DCPP security revision.

3.4.4.1. Period 0: Initial Shutdown

Period 0 begins when Unit 1 is permanently shut down and ends when Unit 2 is permanently shut down. The duration of Period 0 is approximately ten months. During Period 0, the shutdown reactor will be defueled, and the spent fuel transferred to the SFP for wet storage. The second unit will remain operational. In addition, the control room will remain operational to support operation of the second unit and safe storage of spent fuel at the shutdown unit. To ensure that there is no reduction in safeguard effectiveness, the DCPP protective strategy will remain unchanged until the second reactor unit is permanently shutdown and defueled.

During Period 0, the ramp-up of security-related decommissioning planning activities will begin. With the control room operational and the protective strategy unchanged, no NRC security-related exemptions are planned. In addition, no changes to the security plans are expected during Period 0 that would result in a decrease in safeguards effectiveness and require prior NRC approval.

Crystal River Nuclear Power Plant submitted exemption requests and license amendment requests to modify its physical security configuration. However, these changes were primarily to optimize SAFSTOR operations.

As described further in Section 3.4.5, the security posts during Period 0 will initially be the same as the number of pre-shutdown security posts that are required to ensure that there are no reductions in safeguards' effectiveness with one unit shutdown and one unit operational. As Period 0 progresses, security posts will be gradually increased to the Period 1 staffing levels. The increase is to account for the compensatory measures necessary to protect against new security vulnerabilities that did not exist when both units were operating (e.g., new openings in structures to facilitate equipment removal and draining piping that was previously filled with water).

Planned security modifications during Period 0 have been evaluated to ensure that there will be no impact on the operating reactor unit. The security modifications scheduled to be implemented during Period 0 include:

- Installing a "kicker" on the main PA fence to make it more difficult for an adversary to access the area.
- Reconfiguring the delay fence inside of the main PA to provide additional time for security to deter or stop an adversary.
- Backfilling the shutdown unit intake tunnel with dirt or concrete to protect the unattended openings.
- Removing siding from the shutdown unit buttress to improve line of sight and enhance the ability to detect and neutralize potential security threats.
- Constructing and installing fighting positions in the shutdown unit to provide protection for internal responders from an adversary, maintain a good defense in depth and provide continued high assurance of the ability to neutralize an adversary.
- Sealing doorways in the shutdown unit that will no longer be used. With fewer travel routes to access vital equipment and structures, security staff will be able to execute the protective strategy with fewer responders.

3.4.4.2. Period 1: Wet Storage during Zirc Fire

Period 1 begins after permanent shutdown and defueling of the second reactor unit and terminates at the end of the zirc-fire window with spent fuel in the pool. The duration of Period 1 is approximately 1.5 years. All spent fuel is in wet storage, the control room remains operational to support safe storage of spent fuel until the end of the zirc fire window, and decommissioning activities are underway.

During Period 1, the protective strategy will be modified to ensure adequate protection of spent fuel and continuous compliance with 10 CFR 73.55 during the zirc-fire window. To minimize the net increase in security staffing, vital equipment in the shutdown unit that is no longer in use will be de-vitalized and security modifications will be implemented to reduce security posts.

Changes to the security protective strategy and security plans are expected to reflect the shutdown units and installation of security modifications. NRC review and approval will be sought prior to implementation of any security-related change that could potentially result in a reduction in safeguard effectiveness. While the control room is operational, PG&E does not plan to implement NRC security-related exemptions.

During Period 1, security staffing levels consider both the additional security posts and compensatory measures necessary to protect against new security vulnerabilities with both reactor units shutdown and the efficiencies gained after early decommissioning activities.

There are 52 security posts required during Period 1 to protect the DCPP site. Thirty of them are required to implement the DCPP protective strategy. These 30 posts consist primarily of security officers who are stationed and/or patrolling at various locations throughout the plant. An additional eight administrative posts are required for access control to the DCPP site and, DCPP PAs, security escorts and coordination/control of vehicles that access the DCPP site. The administrative posts are also staffed by security officers. Three supervisory posts are required to manage, coordinate and plan work for security resources. An additional 11 posts are staffed by relief officers who are required to comply with California labor laws. Relief officers provide continuous coverage to support California labor law by providing required break and meal times.

Security labor costs are presented as security FTEs. Using the conversion methods described in Table 3-12, the 52 posts equate to 289 FTEs. The 289 FTEs include an additional 17 FTEs compared to the Period 0 security staffing levels. The increase is needed to protect against new security vulnerabilities that did not exist with both units operating. For example, empty intake and discharge tunnels require as many as 25 FTEs for continuous monitoring. These compensatory measures will be eliminated after the tunnels are backfilled with dirt and concrete.

During Period 1, unit specific and common area security modifications will be implemented to minimize the net increase in security staffing because of efficiencies gained in security operations and/or elimination of potential vulnerabilities. Examples of planned security modifications during Period 1 include:

- Backfilling the second shutdown unit intake tunnel and common discharge tunnels with dirt or concrete to protect the unattended openings
- Installing delay cages/gates for the personnel and roll-up doors in the Turbine Building, Auxiliary Building and Fuel Handling Building to give external responders more time to engage an adversary attempting to breach the delay cages and reduce the likelihood of an adversary gaining access to vital equipment and structures
- Removing the 140’ pedestrian bridge (and associated electrical conduits and other structural items) that extends between the Administration Building to the Turbine Building to help early detection of a potential adversary and reduce the likelihood of an adversary gaining access to vital equipment and structures
- Removing the siding from the second shutdown unit buttress to improve line of sight and enhance the ability to detect and neutralize potential security threats
- Constructing and installing fighting positions in the second shutdown unit to provide protection for internal responders from an adversary, maintain a good defense in depth and continue to ensure the ability to neutralize an adversary
- Sealing doorways in the second shutdown unit that will no longer be used. With fewer travel routes to access vital equipment and structures, security will be able to execute the protective strategy with fewer responders

3.4.4.3. Period 2: Wet Storage Post Zirc Fire

Period 2 begins after the zirc fire window and ends after all spent fuel is transferred to the onsite ISFSI. The duration of Period 2 is approximately 5.5 years. All spent fuel is in wet storage as decommissioning activities progress. During Period 2, the control room will be devitalized at the end of the zirc fire window. In addition, a protective strategy will still be required to ensure continuous compliance with 10 CFR 73.55 and adequate protection of spent fuel.

Prior to Period 2, the majority of planned and designed security modifications will have been implemented to eliminate vulnerabilities associated with the shutdown plants. During Period 2, de-energized overhead transmission lines will be removed, eliminating a potential way for an adversary to access the PA. Compensatory measures will be required until the de-energized overhead lines are removed.

To reduce overall security costs and security staffing levels, the DCPP protective strategy will be revised to consolidate or eliminate some security operations and functions, reflect implementation of security modifications, and incorporate approved regulatory relief from NRC security requirements that are no longer applicable. The following exemption requests will be prepared and submitted to the NRC in

Period 1 and implemented in Period 2 after the decay heat associated with spent fuel has sufficiently decreased such that the probability of a zirc fire accident is very low.

- 10 CFR 73.55(b)(3) that requires protection against significant core damage. With the reactor units defueled, the requirement is no longer applicable.
- 10 CFR 73.55(e)(9)(v) that requires the control room to be a vital area. A control room is no longer required after permanent shutdown and defueling.
- 10 CFR 73.55(j)(4)(ii) that requires continuous communications between the central alarm station and the control room. A control room is no longer required after permanent shutdown and defueling.

The exemption requests will be submitted to the NRC at least 18 months in advance to minimize potential delays in implementing security staffing reductions. Sufficient industry precedent exists to support these requests.

Security staffing will remain unchanged until PG&E obtains all required NRC approvals. Once obtained, reductions will be made. With the control room devitalized and the zirc fire window no longer a concern, the number of security posts is expected to decrease to 39 during Period 2. Twenty of the 39 posts will be required to implement the DCPP protective strategy. The eight administrative posts and three supervisory posts will still be required to provide the same functions as described in Period 1. With fewer posts needed to implement the protective strategy, the relief posts will be reduced to eight. Similarly, the total posts, including relief posts, are converted to FTEs. During Period 2, security staffing is expected to decrease from 289 to 207 FTEs due to the reduced security risks with both reactor units shutdown. For example, the 25 FTEs added in Period 1 that provided continuous monitoring of the intake and discharge tunnel openings will be eliminated after the tunnels are backfilled with dirt or concrete.

3.4.4.4. Period 3: Dry Storage (ISFSI Only)

Period 3 begins after the wet storage period (after all spent fuel is transferred from the SFPs to the ISFSI) and ends after all spent fuel and GTCC is transferred to the DOE. The duration of Period 3 is approximately 35 years. During Period 3, decommissioning of the reactor units will continue until the NRC licenses are terminated.

After highly radioactive materials are removed from the DCPP reactor sites, the DCPP nuclear security footprint will be limited to the protection of the ISFSI only, and the focus of the protective strategy will be protecting the spent fuel and GTCC stored at the ISFSI. As such, the required nuclear security staffing in this period is significantly diminished.

PG&E intends to submit an exemption request from the 10 CFR 73.55 security requirements, such that PG&E can transition to a 10 CFR 73.51 security program for a stand-alone ISFSI. A 10 CFR 73.51 security program is subject to less stringent requirements than a 10 CFR 73.55 security program because of the reduced risks associated with ISFSI operations.

Security staffing levels will significantly decrease after the transition from a 10 CFR 73.55 to a 10 CFR 73.51 security program. In addition, the security organization will be restructured, and the security staffing levels will be substantially reduced from the 207 FTEs in Period 2. During Period 3, security functions will primarily be performed by management and/or supervisory personnel working 12-hour shifts; no relief posts are included. The security organization will consist of six security posts supported by a total of 4 security administrative and managerial personnel. The six posts, converted to FTEs, plus the security administrative and managerial personnel total 29 FTEs. The combined benefits associated with an exemption from 10 CFR 73.55, the transition to a 10 CFR 73.51 security program and restructuring of the security organization will result in significant reductions in security staffing levels and overall security costs.

The 10 CFR 73.51 ISFSI nuclear security program will remain in effect until the spent fuel and GTCC are transferred to DOE. Afterward PG&E may seek an NRC exemption from all nuclear security requirements, or the nuclear security program will terminate with the ISFSI license, whichever occurs first.

3.4.5. Security Staffing Projections

The DCPP protective strategy, as approved by the NRC, is the primary basis for determining the number of DCPP security posts necessary to protect the site in accordance with 10 CFR 73.55. Prior to permanent shutdown of the second unit, decommissioning activities will be limited to ensure that there is no impact on the operating unit. After permanent shutdown of the second unit, full-scale decommissioning will begin. To reflect the initial reductions in security staffing (stated in number of posts and FTEs) after permanent shutdown of the second unit, Period 1 security staffing is presented as Period 1a and Period 1b. Period 1a shows the security staffing immediately after shutdown of the second unit. During Period 1a, plant equipment that is no longer in use will be devitalized. In addition, an evaluation of the security protective strategy will be performed. Regulatory approvals will be sought where required for changes that could potentially reduce the safeguards effectiveness. Period 1b shows the security staffing after implementation of identified changes in Period 1a, including the NRC approval, as required, for the updated protective strategy.

Security posts are the security personnel that are needed to implement the DCPP protective strategy and perform site-specific security functions (e.g., communication with local law enforcement and incident response times). Staffing projections also include relief posts to meet the California labor requirements, non-work hour requirements and benefits (e.g., breaks, vacations, and holidays); PG&E bargaining agreements and administrative posts that are responsible for maintaining and executing the access authorization program, fitness for duty program and ancillary security duties, such as vehicle escorts; and managerial posts to supervise security personnel.

Table 3-11 provides an estimate of the number of security posts for the four DCPP decommissioning periods. The decommissioning periods are described in Section 3.4.4. Security modifications are summarized in each decommissioning period and detailed descriptions of each modification are in Section 4.1.1.2.3. The security officer staffing costs for period 0 are not included in DCPP Decommissioning costs.

Table 3-11: DCPP Decommissioning Security Posts

<table>
<tr><th rowspan="2">DCPP Periods</th><th rowspan="2">Period Duration</th><th colspan="6">Posts</th></tr>
<tr><th>Protective Strategy</th><th>Security Support (24/7 shift)</th><th>Security Support (10 hr shift)</th><th>State Law Relief</th><th>Supervision</th><th>Total</th></tr>
<tr><td>0
Initial Shutdown
See Note 1</td><td>8 months</td><td>See Note 2</td><td>2</td><td>6</td><td>See Note 2</td><td>3</td><td>See Note 2</td></tr>
<tr><td>1a
Zirc-Fire</td><td rowspan="2">18 months</td><td>30</td><td>2</td><td rowspan="2">6</td><td>11</td><td rowspan="2">3</td><td>52</td></tr>
<tr><td>1b
Zirc-Fire</td><td>29</td><td>2</td><td>11</td><td>51</td></tr>
<tr><td>2
Post Zirc-Fire</td><td>5.5 years</td><td>20</td><td>2</td><td>6</td><td>8</td><td>3</td><td>39</td></tr>
<tr><td>3
ISFSI Only</td><td>35 years</td><td>5</td><td>0</td><td>0</td><td>See Note 3</td><td>1</td><td>6</td></tr>
<tr><td colspan="8">Note 1: Period 0 posts are not included in Decom costs
Note 2: Safeguards Information
Note 3: All management personnel working 12-hour shifts with no relief posts</td></tr>
</table>

To determine the number of personnel required, PG&E first determined the number of security posts required during each period. To ensure adequate staffing, each security post requires 5.5 FTEs for continuous coverage (24 hours/day, 7 days/week) and 1.5 FTEs for each 10-hour shift. In addition, one relief post is assigned to every four posts to account for personnel breaks in accordance with California labor laws. For example, assume 12 security posts are required. The equivalent FTEs for security posts are shown in Table 3-12.

The 5.5 multiplier for 24/7 shifts and the 1.5 multiplier for 10-hour shifts begin with the number of FTE's required to fill the post (4.2 & 1.0, respectively) per year. Afterwards, the multipliers, based on empirical data from 2017, consider all non-productive time including vacations, sick time, employees on disability, employees on maternity leave, employees on paternity leave and jury duty.

Table 3-12: Equivalent FTE(s) per Security Post(s)

	Shift Duration	Posts	Full Time Equivalents (FTEs)
(1)	24 hrs	12	(12 posts + 12/4 relief posts) x 5.5 = 82.5 FTEs
(2)	10 hrs	12	(12 posts + 12/4 relief posts) x 1.5 = 22.5 FTEs

The estimates of projected security staffing levels are shown in Table 3-13 and Table 3-14. Table 3-13 shows the pre-shutdown and the decommissioning staffing levels for specific milestones when major changes in security staffing are anticipated. The pre-shutdown security staffing levels, which reflect both reactor units and the ISFSI, are shown for comparison with the decommissioning periods. During each decommissioning period, staffing levels will fluctuate as risks are reduced and security modifications are implemented. The milestones correlate to the peak staffing levels that are expected to occur during each period and are based on conservative assumptions of the decommissioning status at the beginning of each period.

Table 3-13 includes the security officers, support personnel, supervisors and management needed to support decommissioning operations, to implement security-related modifications, and to revise security protective strategy and supporting documents for submission to the NRC.

The Period 3 security staffing levels are shown in Table 3-14 to reflect the realignment of security resources during dry storage.

Table 3-13: DCPP Reactor Decommissioning Security Staffing Projections (FTEs)

<table>
<tr><th>Milestone</th><th>Period</th><th>Officers</th><th>AA/ FFD</th><th>Training Staff</th><th>On-Shift Supervisors</th><th>Other (Management and Support)</th><th>Total Staffing</th></tr>
<tr><td>Pre-Shutdown</td><td>N/A</td><td>211</td><td>5</td><td>10</td><td>26</td><td>20</td><td>272</td></tr>
<tr><td>One unit defueled, no plant mods; no NRC regulatory approvals</td><td>0</td><td>211</td><td>5</td><td>10</td><td>26</td><td>20</td><td>272</td></tr>
<tr><td>Both units defueled, no plant mods, no NRC regulatory approvals</td><td>1a</td><td>244</td><td rowspan="2">5</td><td rowspan="2">8</td><td rowspan="2">20</td><td rowspan="2">12</td><td>289</td></tr>
<tr><td>Both units defueled, no plant mods, and NRC regulatory approvals</td><td>1b</td><td>238</td><td>283</td></tr>
<tr><td>Both unit(s) defueled, with plant mods, and NRC regulatory approvals</td><td>2</td><td>173</td><td>5</td><td>5</td><td>20</td><td>4</td><td>207</td></tr>
<tr><td colspan="8">AA – Access Authorization FFD – Fitness for duty
Other - Security Director and Managers (e.g., Operations, Strategy, Programs)</td></tr>
</table>

Table 3-14: DCPP ISFSI Security Staffing Projections (FTEs)

Milestone	Period	Specialist/ Leads	Director DCPP and HBPP	Security Ops Manager	AA/FFD	Security Training and Weapons	Total Staffing
Stand-Alone ISFSI	3	25	1	1	1	1	29
Specialists/Leads:	Management/supervisory personnel that perform security functions						
Notes:	The following functions are captured in the Staffing support plan: ISFSI/I&C/Security Engineer, Procurement/ Work Control. The EP Coord and SGI Coord functions are captured in the Security Ops Mgr position						

3.4.6. DCPP Total Cost Estimate

The decommissioning security cost estimate includes the cost of the security modifications, security staffing and the supporting costs for project management and controls. The security modification costs are based on an Engineering, Procurement, and Construction (EPC) cost estimate performed by a vendor with security modification experience at DCPP. PG&E labor costs for planning, project management, engineering oversight and permitting were added to the EPC cost estimate. Security staffing labor rates are based on current PG&E or industry standards. Labor costs are in 2017$ and are based on straight time hourly rates. The total estimated security cost for decommissioning DCPP is provided in Table 4-1.

3.4.7. Industry Comparisons

Table 3-15 identifies projected staffing levels for DCPP and other decommissioning facilities during similar periods.

Table 3-15: DCPP Security Staffing Projections and Industry Comparisons

Milestone	Period (See Note 1)	DCPP[d] Total Staffing (2 units)	Industry Comparisons (Source – Benchmarking)	
			SONGS[b,c] (2 units)	Crystal River 3[a,c] (1 unit)
Pre-shutdown	N/A	272	450	225
Both units defueled, no plant mods, no NRC regulatory approvals	1a	289	360	*
Both units defueled, no plant mods, and NRC regulatory approvals	1b	283	216	*
Both unit(s) defueled, with plant mods, and NRC regulatory approvals	2	207	183	*

Milestone	Period (See Note 1)	DCPP(d) Total Staffing (2 units)	Industry Comparisons (Source – Benchmarking)	
			SONGS(b,c) (2 units)	Crystal River 3(a,c) (1 unit)
Stand-alone ISFSI	3	29	34	50

a. SAFSTOR plant b. DECON plant c. General ISFSI License d. Specific ISFSI License * No data

Note 1: Period 0 was excluded since the table comparisons do not include a site with one unit shutdown and one unit operational.

The industry comparisons to DCPP security staffing levels in Table 3-15 are illustrative only. Security staffing projections are dependent on several variables, such as site-specific configurations and vulnerabilities, bargaining agreements and state labor laws. Thus, there is no direct correlation between projected DCPP security staffing levels and costs to other decommissioning sites. Several factors affect the DCPP security related cost estimate that are different from other decommissioning sites.

The timing of major security staffing reductions after permanent shutdown was obtained from benchmarking. Typically, the decisions to reduce security staffing were made based upon site-specific milestones. To the extent practical, PG&E mapped the industry data to the DCPP milestones that were reasonably similar to show the relative comparison. Except for Period 3 (stand-alone ISFSI), there is no direct correlation between projected DCPP security staffing levels and the industry comparisons during Periods 1 and 2.

3.4.7.1. Location, Terrain and Site-Specific Vulnerabilities

The DCPP terrain is more challenging than most U.S. nuclear power plant sites. The DCPP is a dual reactor unit site on approximately 750 acres of land. The plant site occupies a coastal terrace that ranges in elevation from 60' to 310' above sea level and is approximately 1,000 ft. wide. Plant grade is at elevation 85'. A portion of the site boundary and principal structures are bounded by the Pacific Ocean. The seaward edge of the terrace is a near-vertical cliff. After permanent shutdown of both units, the proximity of the intake and discharge structure openings to the SFP areas creates additional security challenges to prevent potential adversaries from entering the PA. Given the size, terrain, and site-specific challenges at the DCPP site, additional security measures and staffing are necessary to meet regulatory requirements.

In comparison, SONGS is a three-unit site on 84 acres of federal land. The SONGS topography is sloping coastal plain that terminates at the shoreline by high sea cliffs. The site is surrounded principally by unused land and the natural exclusion provided by the U.S. Marine Corps reservation. The intake and discharge structure openings are not close to the SFP area. Crystal River is a single-unit site on less than 130 acres. The Crystal River topography is flat and previously disturbed land.

3.4.7.2. Transfer of Spent Fuel and GTCC to DOE

PG&E assumes that DOE would begin picking up DCPP spent fuel in 2038 with full acceptance of all spent fuel and GTCC by 2067. As a result, PG&E assumes security costs are estimated through 2067. In comparison, SONGS and Crystal River DCEs assumed complete transfer of spent fuel to DOE in 2049 and 2036, respectively. Therefore, the DCPP cost estimate includes 16 to 31 additional years of security costs until all spent fuel and GTCC is transferred to DOE. Table 3-16 shows that DCPP security staffing costs are approximately $7.0 million/year during dry storage (Period 3).

3.4.7.3. State of California Labor Laws

California labor laws will result in higher security staffing levels than decommissioning sites in other states with less restrictive labor laws. For example, California law mandates periodic breaks for meals and rest periods, and a recent California Supreme Court decision concluded that security personnel could not be on call during breaks, necessitating separate security coverage.[6] Labor laws for decommissioning sites on federal land (e.g., SONGS) can be less stringent than state labor law requirements.

The security posts used to account for security personnel breaks are shown in Table 3-11.

3.4.7.4. Timing of Permanent Shutdown

Permanent shutdown of the last DCPP operational unit will occur during Period 1. In Period 1, all spent fuel is in the SFP; however, the spent fuel has not sufficiently cooled to ensure the probability of a zirc-fire accident is very low. Some utilities made the decision to permanently shutdown near the end of or after the zirc fire window of concern.

For instance, SONGS Units 2 and 3 shutdowns in January 2012 due to SG-related issues and submitted the certification of permanent shutdown to the NRC in June 2013. Thus, the SONGS to DCPP security staffing comparisons during Period 1 are illustrative only. As a result, SONGS Period 1a staffing levels are higher than the DCPP staffing levels and reflect the security staffing required to meet the pre-shutdown security requirements. The SONGS staffing levels shown for Period 1b reflect the security staffing post-zirc fire accident. During Period 1b, fewer security vulnerabilities existed at SONGS compared to DCPP during the same period. Therefore, the DCPP staffing levels during Period 1b are higher because the staffing levels include the security staffing needed to protect spent fuel before the end of the zirc fire window and relief staff for security posts.

Crystal River shutdown in September 2009 due to containment structural issues and submitted the certification of permanent shutdown to the NRC in February 2013. As a result, the potential risk

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[6] *Jennifer Augustus v. ABM Security Services Inc.,* 2 Cal.5th 257 (2016). Industrial Welfare Commission Wage Order No. 4-2001 cited as 8 Cal. Code Regs. § 110430

associated with a zirc fire accident were significantly lower, and fewer security vulnerabilities existed compared to DCPP during the same period.

3.5. SPENT NUCLEAR FUEL

This section addresses the treatment of SNF at DCPP, and responds to the Commission's directives to (1) assess possibilities for pre-shutdown and post-shut down expedition of dry cask loading; (2) identify potential cost savings of a transition from wet to dry SNF storage; and (3) provide an updated assessment of when DOE will begin pick-up of SNF or any progress with approvals for a permanent or long-term, off-site SNF repository.

3.5.1. Current Dry Cask Loading Status

The DCPP RPVs are designed to hold a core of 193 fuel assemblies. The cores are designed to run at full power for approximately 20 months before the fuel is taken out of the RPV and placed in the SFP to allow for a refueling outage when a new core will be loaded into the reactor. The time period that the reactor is operating between refueling outages is referred to as a cycle. The new core loaded during a refueling outage typically contains approximately a third each of new fuel assemblies that have never been in the core, fuel assemblies that have been in the core for one cycle, and fuel assemblies that have been in the core for two cycles. Typically, once a fuel assembly has been in the core for three cycles it will no longer be used in a future core and will remain in the SFP to cool until it has met the heat load parameters for it to be transferred to dry cask storage. Once the SNF is placed in a dry storage canister, it is transferred to the ISFSI, where it will be maintained until it can be transferred to an offsite licensed facility.

As of the time of this filing there are a total 1,856 SNF assemblies stored within the ISFSI. The SNF assemblies are stored within 58 Holtec HI-STORM 100 casks, with 32 assemblies per cask.

There are currently 744 and 768 SNF assemblies stored in the Unit 1 and 2 SFPs, respectively. PG&E anticipates that when DCPP Unit 2 is shut down for the last time, there will be 1,261 and 1,281 SNF assemblies stored in the Unit 1 and 2 SFPs, respectively.

3.5.2. Feasibility of Both Pre- and Post-Shut Down Acceleration of Dry Cask Loading

In the 2015 NDCTP decision, the Commission directed PG&E to include in PG&E's 2018 NDCTP an assessment of both pre-shutdown and post shutdown options and costs for expediting dry cask loading from the 10-year assumption in the 2015 NDCTP DCE (Reference 3.3).

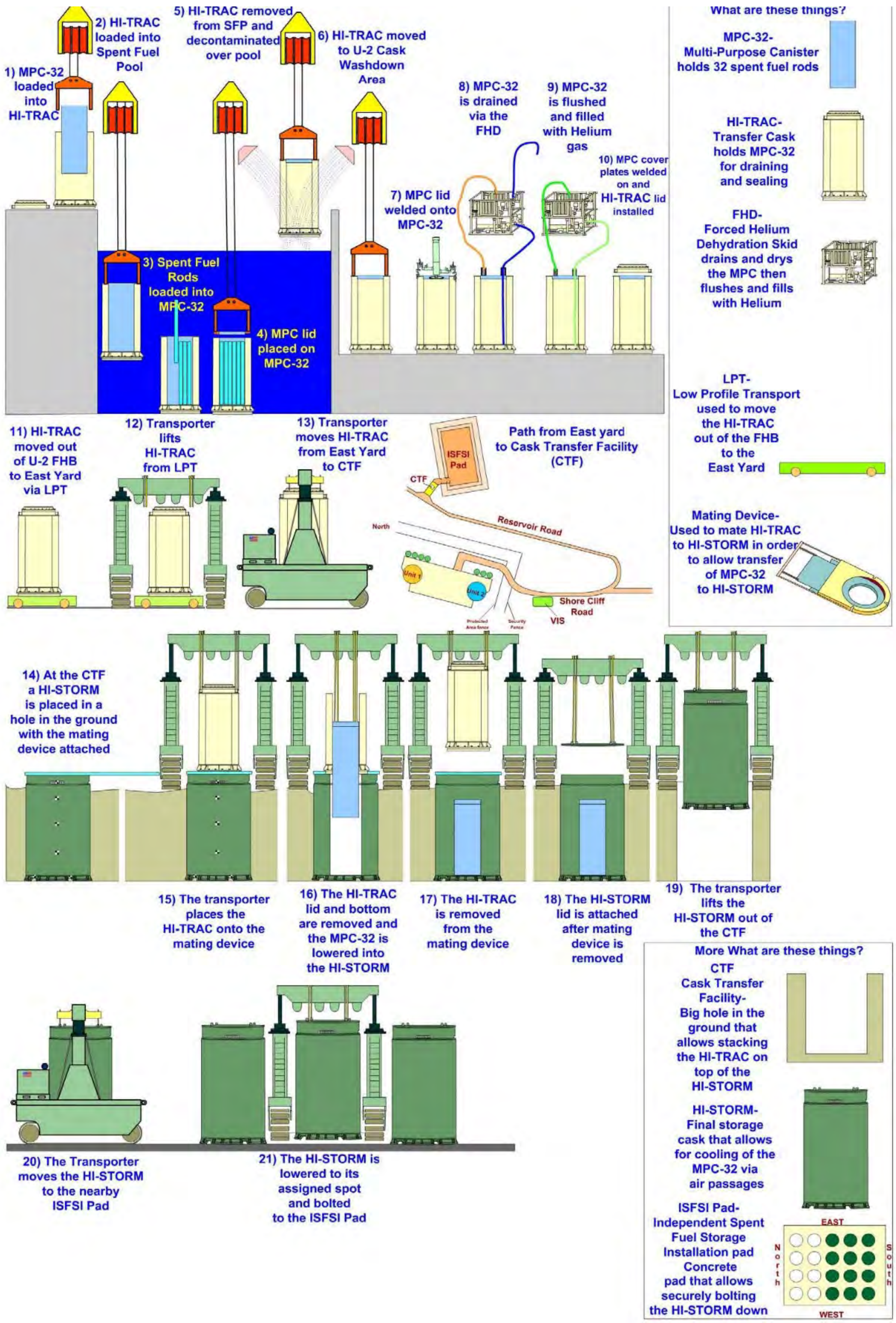
3.5.2.1. Dry Cask Storage License Requirements

The current dry cask storage system at the DC ISFSI[7] uses the Holtec International HI-STORM 100SA overpack, HI-TRAC 125D transfer cask and Multi-Purpose Canister (MPC) capable of holding 32 fuel assemblies (MPC-32). This system is approved for use by general licensees under NRC Docket Number 72-1014. For a general license, the dry cask vendor performs the licensing to gain the NRC's approval for the dry cask design to be used. However, DCPP is not authorized as a general licensee, but instead uses the system under a site-specific ISFSI license (NRC Docket Number 72-26). PG&E chose to obtain a site-specific ISFSI license to adequately address DCPP site-specific conditions, including seismic design basis requirements and the associated impacts to the system's thermal capacity.

The impacts of the DC ISFSI site-specific seismic conditions have to be evaluated in detail for seismic response of the storage system during an earthquake and the potential of thermally limiting configurations (i.e., when there is the least amount of margin as compared to the allowable design heat load) when SNF is transferred from the SFP to the ISFSI. To meet DC site-specific seismic design requirements, PG&E implemented a one-of-a-kind anchored cask design for the current Holtec vertically orientated storage system. The current storage system's most thermally limiting configuration is when the loaded storage cask is in the cask transfer facility (CTF) (see steps 17 and 18 in Figure 3-12) because the CTF limits the air flow around the canister. DCPP's design of a below-grade CTF was implemented because it was needed to minimize the seismic spectral response of the overpack and transfer cask while the transfer cask is connected to the storage cask to allow the loaded canister to be transferred from the transfer cask to the overpack (see steps 15 and 16 in Figure 3-12). For other plants with the HI-STORM system the overpack is placed on the ground and the transfer cask is placed on top of the overpack. The loading configuration used at other plants would not meet NRC requirements given DCPP's seismic spectrum.

[7] The dry cask storage facility within the DCPP site boundary is a site-specific 10 CFR 72 license and is referred to as DC ISFSI. PG&E possess two 10 CFR 50 licenses for DCPP Units 1 and 2. The units and associated facilities are referred to as DCPP.

Figure 3-12: Overview of DCPP Cask Loading Process



Based on NRC requirements, minimum time allowed before SNF can be removed from the SFP and placed into dry storage depends on three factors: (1) burnup, which limits the maximum total heat load the NRC has approved for a canister design; (2) the maximum total heat load the NRC has approved for a canister design; (3) the maximum heat load for a single SNF assembly the NRC has approved for a canister design. The maximum heat load for a single SNF assembly is to ensure the localized physical properties of the canister design are not impacted for storage and transportation requirements (e.g., ensures the material is not weakened from high localized temperatures); it also determines the shortest cooling time that the NRC will allow any assembly to be placed in dry cask storage.

To conceptualize burnup, it helps to understand how uranium fuels a reactor. Before it is made into fuel, uranium is processed to increase the concentration of atoms that can split in a controlled chain reaction in the RPV. The atoms release energy as they split. This energy produces the heat that is turned into electricity. In general, the higher the concentration of those atoms, the longer the fuel can sustain a chain reaction. And the longer the fuel remains in the RPV, the higher the burnup. In other words, burnup is a way to measure how much uranium is burned in the RPV. It is the amount of energy produced by the uranium.

Burnup is expressed in gigawatt-days per metric ton of uranium (GWd/MTU). Over time, nuclear fuel designs have improved to allow for a higher average burnup. Utilities now can get more power out of their fuel before replacing it. This means they can operate longer between refueling outages. It also means they use less fuel. The burnup level affects the fuel's temperature, radioactivity, and physical makeup. It is important to the NRC's review of SNF cask designs because each system has limits on temperature and radioactivity. How hot and radioactive SNF is depends on burnup, the fuel's initial makeup and conditions in the core. All these factors must be considered in designing and approving dry storage and transport systems for SNF. (See Reference 3.4) The NRC's standard approach for approving maximum heat loads for a dry cask design is based on whether the canister will contain SNF assemblies with a burnup greater than 45 GWd/MTU. A canister that will contain one or more SNF assemblies with a burnup greater than 45 GWd/MTU will have a maximum heat load limit that is lower than that of a canister that will contain only SNF assemblies with equal to or less than 45 GWd/MTU.

Once the maximum heat load limit for a canister is determined, if it will contain a SNF assembly with greater than 45 GWd/MTU, the utility must determine which SNF assemblies from the inventory of SNF in the SFPs it can load into the canister while remaining below the maximum heat load total for the canister while still meeting the maximum heat load limit for a single fuel assembly. There are only so many total kilowatts of heat allowed to be initially stored in a canister. Dividing the total number of kilowatts allowed for a canister by the number of SNF assemblies that can be stored in the canister provides the average heat load allowed per SNF assembly to be stored in the canister. For every SNF assembly that the utility wants to store in the canister that has a heat load above the average heat load allowed per SNF assembly for the canister, the utility will have to load a SNF assembly that has a heat load an equivalent amount below the average load allowed per SNF assembly for the canister. In simple terms, for every relatively hot fuel assembly loaded in the canister an equally cool fuel assembly, relative to the average heat per SNF assembly, needs to be loaded in the canister. The relative temperature of a SNF assembly is primarily based on how long it has been cooling in the SFP (e.g., the longer it is in the SFP the cooler it is). PG&E's strategy for being able to empty the entire SFP as quickly as possible must consider the entire mix of SNF assembly heat loads contained within the SFPs currently and through the remainder of the operating licenses.

In addition to the maximum heat load limits, there are additional design basis criteria, such as natural disasters, that need to be approved by the NRC for a dry cask storage design. The design basis criteria are based on site-specific conditions. The dry cask storage system general licenses do not bound every DCPP site-specific condition and require additional licensing, potential design changes and NRC approval to allow the use of a generally licensed design at a site that has a condition not bounded by the general license.

3.5.3. Alternatives for Acceleration of Dry Cask Loading

The Commission directed PG&E to look at ways to expedite dry cask loading. This section summarizes PG&E's evaluation of what is technically feasible.

The current dry cask storage design in use at DC ISFSI is limited by the ISFSI Technical Specifications to a minimum cooling of 10 years for the amount of burnup of the DCPP SNF. The Technical Specifications limits are based on the design basis accident evaluations that use the physical properties of the storage system. The thermally limiting component for the current DC ISFSI system is the SNF fuel basket. To accelerate transition from wet storage to dry storage of SNF before a 10-year cooling time, a dry cask storage design system with a heat load capacity higher than the one currently licensed by the NRC for the DC ISFSI will have to be implemented. There are three major vendors with dry cask storage system designs approved by the NRC for use in the United States. Those three vendors are Holtec International (Holtec), NAC International (NAC) and Orano (formerly known as and referred to here as TransNuclear (TN) Americas). The Holtec and NAC dry storage systems implement storage configuration with the SNF in a vertical orientation. The TN Americas dry cask storage system implements a storage configuration with the SNF in a horizontal orientation. All three of these vendors have gained approval, or are pursuing approval, from the NRC for canister designs with similar maximum heat loads.

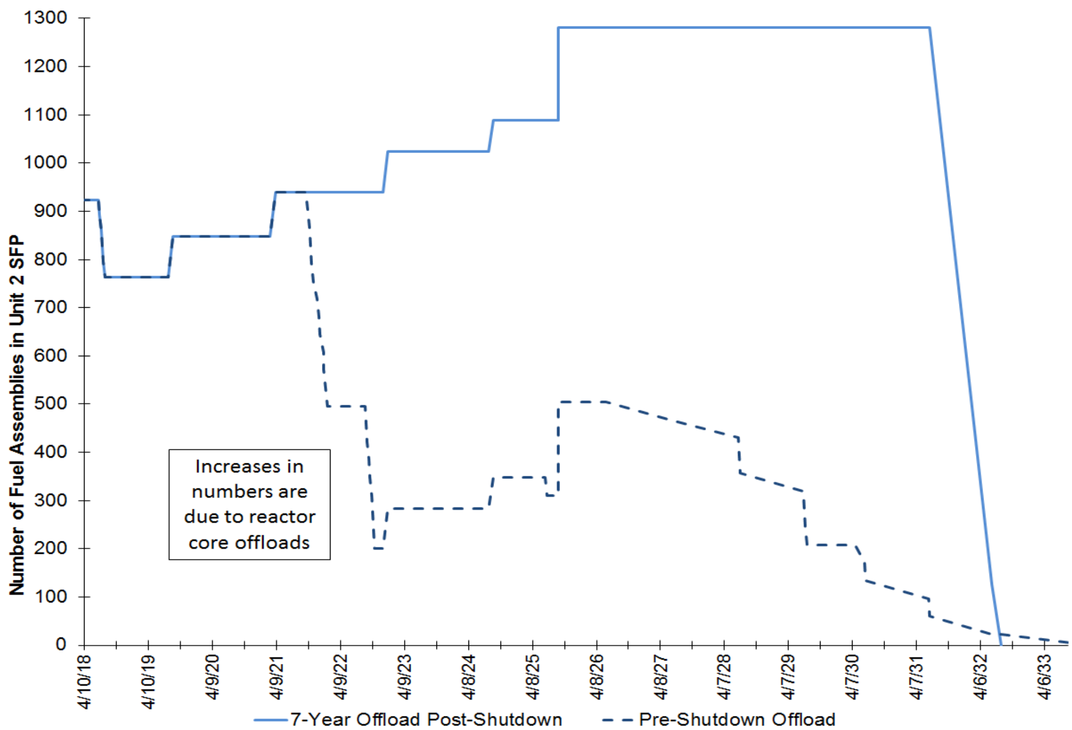
To implement a new design for the DC ISFSI from any of these three vendors would require PG&E to pursue one of two options -- obtain NRC approval to amend the site-specific DC ISFSI license to incorporate a generally licensed design or perform an evaluation to prove that the general licensed design already bounds the site-specific conditions at DCPP. If the evaluation found that the general design did not bound the site-specific conditions, then PG&E would have to obtain NRC approval to amend the general license before it could implement a new design. Once a vendor is contracted to perform the required evaluations to determine the design and licensing bases changes needed to implement a new system, it would take approximately three years complete the analyses and receive NRC approvals. That time frame depends on the significance of any design change needed and if any public hearings are required. An amendment to a general ISFSI license may also be complicated by any other license amendments that would be concurrently under review by the NRC for other utilities that are using the general design.

In 2017, PG&E evaluated options for expedited transfer of SNF and assessed the cost-effectiveness and regulatory and operational risks and benefits associated with these options. The Holtec and NAC designs are very similar; the only notable difference is that the NAC design is larger dimensionally and heavier than Holtec's. Based on these similarities, PG&E only evaluated Holtec and TN Americas in greater detail. With similar storage capabilities between Holtec and NAC PG&E assumed that any design changes needed to implement a NAC system versus a Holtec system would be similar or greater in difficulty and cost. For both Holtec and TN Americas, multiple systems/designs were evaluated along with multiple loading scenarios to optimize the date that the last SNF would be removed from the SFPs.

PG&E has concluded that pre-shutdown acceleration of the SNF offload schedule would mean that SNF would be kept in the SFPs longer than if it was removed all at once after DCPP is shutdown. This is driven by the fact that during decommissioning the hottest fuel assemblies in the SFP will be those in the reactor core at the time of the final shutdown. The relatively high heat loads and the burnup of these SNF assemblies will be the limiting factor on how soon all the SNF assemblies will be placed into dry cask storage. As explained above in the discussion of having to load a relatively equivalent hot and cool SNF assembly in a cask, SNF assemblies with lower relative heat loads will be needed to offset the higher heat loads of the SNF assemblies that will be in the reactor core at the final shutdown to meet the maximum heat load limit for the canister. If pre-shutdown dry cask storage were to be accelerated, it would offload SNF assemblies to dry cask storage sooner, and therefore, not allow them to cool longer in the SNF pools and lower their relative heat loads. Therefore, to accelerate the transfer of all SNF assemblies to dry cask storage, the current inventory of SNF assemblies should remain in the SFPs to allow them to cool longer and lower their relative heat load to offset the relatively higher heat loads of the SNF assemblies that will be in the reactor core at the final shutdown. Figure 3-13 is a graphic example of the above description on the impact of pre-shutdown offloading versus post-shutdown offloading, with the assumption that a dry cask storage system with a higher heat load capacity is licensed and available for implementation at the DC ISFSI in 2021, for illustrative purposes only. As shown in this figure, by offloading SNF pre-shutdown, the final SFP offload date is increased by 1.4 years as opposed to only offloading SNF post-shutdown.

Accelerating pre-shutdown transfer from wet to dry storage would result in SNF being in the SFPs longer, increasing the costs and total duration for decommissioning. Section 3.5.6 shows that the annual cost is $109.1 million higher for each additional year the SNF is in wet storage versus dry storage.

Figure 3-13: Spent Fuel Pool Offload Example Comparing Pre-Shutdown versus Post-Offload

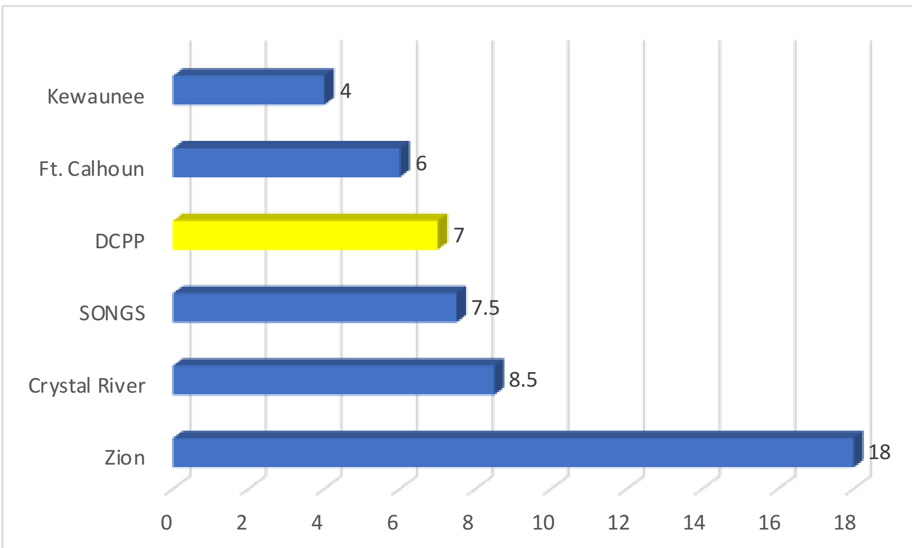


3.5.4. Comparison to Similar Facilities

Dry cask storage systems are designed and licensed for boiling water reactor (BWR) or pressurized water reactor (PWR) fuel and may only contain SNF from the corresponding reactor design. DCPP uses a PWR design. There are eight PWR power plants that have entered, but not completed decommissioning or have announced a retirement date. Of the eight PWR power plants, five have completed or officially communicated their proposed schedule to complete the transfer of SNF to dry cask storage through a Post Shutdown Decommissioning Activities Report (PSDAR) to the NRC. The average SNF transfer duration of these five PWR power plants is approximately 8.5 years. (See Figure 3-14 for the number of years these five PWR power plants estimate they will need to complete the transfer of SNF to dry cask storage.) Only Kewaunee implemented, and Fort Calhoun has officially stated in its PSDAR that it intends to complete transfer of all SNF to dry cask storage in less than seven years. Kewaunee implemented a NAC general license design to complete the transfer of all SNF to dry cask storage within approximately four years. Fort Calhoun has forecast completing the transfer of all SNF to dry cask storage in approximately six years. Fort Calhoun is planning to use a general licensed TN America dry cask storage system.

At the time that Kewaunee and Fort Calhoun shutdown, these two plants had approximately one-tenth of the amount of high burnup fuel that DCPP is forecast to have at final shutdown for Units 1 and 2. As a result, these two plants had a final SNF inventory requiring fewer casks with more limiting heat loads, and therefore have significantly greater flexibility in cask loading options than DCPP is expected to have. The site-specific seismic design basis for Kewaunee and Fort Calhoun are lower than the design basis requirements for DC ISFSI. As stated earlier, the impacts of the DC site-specific seismic conditions must be evaluated in detail for seismic response of the storage system during an earthquake and the potential of thermally limiting configurations, such as a storage cask loaded with SNF while in the Cask Transfer Facility, during the process of transferring SNF from the SFP to the ISFSI. The general licensed NAC and TN Americas dry cask storage system designs do not meet the current DC ISFSI design and licensing bases and would require additional NRC review and approval for any design changes needed to meet the DC ISFSI site-specific seismic design basis requirements, which may result in a lower maximum heat load limit from the NRC.

Figure 3-14: Years to Complete the Transfer of SNF to Dry Cask Storage



PG&E has determined that expediting post-shutdown transfer of SNF to dry cask storage from the 10-year ISFSI Technical Specification limit, used in the 2015 NDCTP DCE, to seven years is technically feasible with the implementation of a new storage system with a higher heat load capacity. The assumption of a seven-year offload duration post-shutdown is consistent with CPUC findings and similar to the time frame at SONGS; it expects to complete its transfer of SNF to dry cask storage, 7.5 years after its shutdown. The cost estimate to implement the acceleration of dry cask storage with a seven-year post-shutdown duration is in Section 4.1.2.3.3.

3.5.5. Potential Transition from Wet to Dry Spent Nuclear Fuel Storage in Seven Years

It is technically feasible to expedite the fuel offload schedule from the current storage systems design and licensing limit of 10 years to seven years by implementing a new storage system with a higher heat load capacity. PG&E looked at dry storage system designs that are currently under review by the NRC with a high likelihood of being approved by the NRC which would be bounding of DCPP site-specific conditions prior to the Unit 2 shutdown date. To implement a new storage system will require a request for proposal from vendors. This request for proposal will result in DCPP specific information being provided to selected vendors to enable them to identify design and licensing bases changes that will be required for a new storage system to meet the DCPP site-specific requirements. The proposals from the vendors will include costs for design and licensing bases changes, implementation of changes and new system components, and purchase of new system components. PG&E will evaluate the proposals and select one. Once the selected vendor is under contract then the design and licensing change process will start and conclude with the required approvals from the NRC. Once NRC approval is obtained, then physical modifications at the plant can commence to implement the new storage system, if required.

Technology for dry cask storage is continuously improving and the potential for shorter SNF cooling times may be expected. But, as these designs have not been approved by the NRC for the DC ISFSI at this time, and there remains significant uncertainty as to the maximum heat load limits the NRC may require for the DCPP site-specific seismic design basis, it is reasonable to assume that SNF assemblies will be transferred to the DC ISFSI within seven years of Unit 2 shutdown (See Reference 3.3).

3.5.6. Annual Costs of Wet versus Dry Spent Nuclear Fuel Storage

To determine the annual cost difference of wet SNF storage versus dry SNF storage, PG&E compared average annual costs of each decommissioning scope (as listed in Table 1-1) for both time periods. The annual average cost comparison showed that most of the cost difference is associated with (1) Program Management, Oversight, and Fees and (2) Security Operations. This finding is consistent with staffing discussions in Sections Security3.4 and 4.1.1.9 that describe staffing, oversight, and fee reductions as the radiological risk is reduced at the site. Table 3-16 presents the annual average cost difference between wet SNF storage and dry SNF storage. Note that this annual average cost is a snapshot based on the integrated schedule and associated cost estimate presented in this DCE. Potential impacts from changes to the SNF transfer schedule are discussed below.

Table 3-16: Annual Average Cost Difference Between Wet and Dry SNF Storage

	Program Management, Oversight, and Fees (in thousands) (3)	Security Operations (in thousands)
Wet Storage Period (1)	$77,829	$42,304
Dry Storage Period (2)	$4,047	$6,951
Difference	$73,782	$35,353
Total	**$109,135**	

Notes:

(1) The 2028-2031 timeframe is used to represent the wet SNF storage period. Wet storage begins in 2025; however, the annual average costs for 2025-2027 were not included in this comparison because those years include operational transitions and site infrastructure modifications that skew the annual wet SNF storage cost calculation (see Section 4.1.1.2).

(2) The 2040-2044 timeframe is used to represent the dry SNF storage period. While all SNF is transferred to the ISFSI by 2032, the years 2040-2044 were used in the annual cost comparison because these years

represent the base annual cost of dry fuel storage after termination of the Part 50 licenses, and thus, do not include costs associated with personnel still supporting the remainder of power plant decommissioning (i.e., Part 50 license termination).

(3) Does not include the following costs in Program Management, Oversight, and Fees because including their expenditures would alter the calculations of the comparison of wet and dry SNF storage and are not impacted by the timing of the transition to dry fuel storage: severance, future land use, spent fuel management plan, license termination plan, and site characterization.

Changes to the schedule for transferring SNF to the ISFSI (other than the seven years assumed in the DCE) will need to be assessed for overall cost impacts to the DCE on a case-by-case basis due to the integrated nature of the site-specific DCE. While the average cost difference described above will not be affected by modifying the seven-year SNF offload to the ISFSI, there will likely be impacts resulting from other decommissioning projects or unassigned costs. For example, if the SNF offload duration is increased, the overall number of project personnel prior to SNF offload would be evaluated for potential reduction (e.g., same amount of work scope, but over a longer duration may result is needing less personnel). In another example, if the SNF offload schedule were further expedited, there is a potential cost impact related to commencement of RPV and internals segmentation

As discussed in Section 4.1.1.4, the RPV and internals segmentation is scheduled to begin an optimal time after permanent shutdown. This timing is based primarily on the amount of time after permanent shutdown required for adequate radioactive decay to occur, thereby optimizing the RPV and internals segmentation schedule by allowing for segmentation into larger pieces. If the SNF transfer was further expedited, this scope of work would also likely require advancement in the decommissioning schedule to achieve the full cost savings from expediting SNF transfer to ISFSI. However, additional schedule duration would be required to segment the RPV internals into smaller individual segments to limit the total radionuclide concentrations within each package, additional containers would be required to ensure radioactivity limits of each package are met, and increased transportation and disposal costs would be incurred as a result of the additional waste containers required. For these reasons, the overall cost for RPV and internals segmentation would increase, thus, reducing the actual cost savings from expediting SNF transfer to the ISFSI.

3.5.7. Status of Industrywide Permanent or Temporary SNF Repository Plans

Congress passed the “Nuclear Waste Policy Act” (NWPA) in 1982, assigning the federal government’s long-standing responsibility for disposal of the SNF created by the commercial nuclear generating plants to the DOE. PG&E, along with other nuclear power plant operators, entered into a standard nuclear SNF disposal agreement with the DOE; these agreements provide that starting January 31, 1998, the DOE would pick up SNF to transport it to a permanent repository. The DOE has never established a permanent repository or interim facility and has never picked up any SNF. In its decommissioning estimates PG&E assumes that it will continue to incur these costs until the date it assumes the DOE will have completed picking up SNF. This section discusses developments since the filing of the 2015 NDCTP application.

In June 2017, a U.S. House Energy and Commerce subcommittee on environment approved the Nuclear Waste Policy Amendments Act and the House of Representatives approved it on May 10, 2018. The bill is designed to move along the stalled Yucca Mountain nuclear waste repository (See Reference 3.5). The Senate is reportedly preparing its own bill to address nuclear waste storage, with an emphasis on temporary sites to address the growing stockpiles of SNF and materials (Reference 3.6). That bill has yet to be filed. If the Senate approves a bill, any differences would need to be reconciled in a House-Senate conference committee, which would write final legislation. Although the House bill called for a restart of licensing for Yucca Mountain with a budget of $120 million for fiscal year 2018, Congressional funding was not appropriated.

3.5.7.1. Expected Date of Operation

When the Yucca Mountain project was authorized in 2002, the DOE projected that it would be open to accept fuel by 2010 but by 2006, after years of studies and design delays, the DOE revised its projected opening date to 2017. In 2007, the DOE again revised its anticipated 2017 opening date, estimating that the repository would not be operational until 2020 at the earliest (See Reference 3.7).

As a result, the project has been delayed, although licensing was restarted. Because of these delays, the U.S. Government Accountability Office (GAO) has stated that development of the site, if approved to restart by Congress, would likely take several years. The NRC has also reported that the licensing process could take up to three years. Based on the NRC estimate, if the project were approved in 2018 to restart, the license to operate would not be ready until 2021 to 2023. Assuming further delays as anticipated by the U.S. GAO to resurrect and reorganize all the previous documentation, re-baseline and prepare the detailed design, and construct the site, the soonest the repository is likely to be operational and accepting SNF or GTCC waste from the DC ISFSI would be the late 2030s (See Reference 3.8).

3.5.7.2. Consolidated Interim Storage Facility

<u>Waste Control Specialists</u>

In a letter dated April 28, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16133A070), Waste Control Specialists, LLC (WCS) applied for a specific license pursuant to DC ISFSI 10 CFR 72 Licensing Requirements for the Independent Storage of SNF, High-Level Radioactive Waste, and Reactor-Related GTCC Waste. In the letter, WCS requested authorization to build and operate a consolidated interim storage facility (CISF) for SNF and reactor-related GTCC waste in Andrews County, Texas. This application sought to store up to 5,000 metric tons of uranium for a period of 40 years in the CISF and states that WCS has selected AREVA and NAC International as the vendors to provide the canister-based storage systems at the CISF.

In addition, in a letter dated July 21, 2016, WCS requested that the NRC initiate its EIS process for the WCS CISF license application as soon as practicable (ML16229A340). In a letter dated October 7, 2016, the NRC informed WCS of its decision to start the EIS process before making a decision on docketing the application (ML16285A317). On November 14, 2016, the NRC published a notice in the Federal Register announcing its intent to prepare an EIS and to open the scoping period for the EIS (81 Federal Register 79531).

The NRC staff reviewed the WCS application and concluded it provides information in sufficient detail to enable the staff to conduct its detailed review. The NRC staff anticipated completing its safety and environmental reviews by the third quarter 2019. (See Reference 3.9)

In a letter dated April 18, 2017, WCS requested that the NRC temporarily suspend all safety and environmental review activities as well as public participation activities associated with WCS' license application until it had completed its sale to EnergySolutions. WCS stated that it expects to go forward with the project at the earliest possible opportunity after the sale is completed. The sale did not go through, however.

On March 13, 2018, Orano USA and WCS stated in a press release (See Reference 3.10) that they intended to form a joint venture to license a CISF for used nuclear fuel at the WCS site in Andrews County, Texas. The joint venture was formed and named Interim Storage Partners. On June 8, 2018, Interim Storage Partners submitted a renewed CISF license application to the NRC and requested the NRC resume its review of a revised CISF license application originally submitted April 2016 and docketed by the NRC for review in January 2017 (Docket No. 72-1050) (Reference 3.11). The NRC staff reviewed the renewed application from WCS and concluded it provides sufficient information for docketing, and for the staff to begin a detailed safety, security, and environmental review. The NRC staff expects to complete its safety, security, and environmental reviews by August 2020 (Reference 3.12). It should be noted that the dry cask system in use at the DC ISFSI is a Holtec International (Holtec) system. It is not clear if these canisters will be compatible with systems proposed to be implemented at WCS, or if WCS plans to license other dry cask systems for use at its facility in the future.

Holtec International

In a letter dated March 30, 2017 (ADAMS Accession No. ML17115A431), Holtec submitted to the NRC an application for a specific independent SNF storage installation license to construct and operate the HI-STORE CISF in Lea County, New Mexico, in accordance with the requirements of 10 CFR 72 (See Reference 3.13). The license application seeks NRC approval to store up to 8,680 metric tons uranium of commercial SNF to be contained in 500 canisters of the HI-STORM UMAX Canister storage system for a 40-year license term. The application states that the HI-STORM UMAX Canister storage system has been engineered to store the entire complement of canisters currently deployed at ISFSIs around the country. The NRC staff reviewed the Holtec application, as supplemented, and concluded it provides sufficient information for docketing, and for the staff to begin a detailed safety, security, and environmental review. The NRC staff expects to complete those reviews by July 2020 (See Reference 3.14). It should be noted that the Holtec application for this initial phase does not request authorization to store GTCC waste.

3.5.8. Updated Assessment of Commencement of DOE SNF Pickup at Diablo Canyon

There is no new substantive information from the DOE or any other source since the last NDCTP decision regarding exactly when the DOE will begin picking up SNF. Many complex technical, political, and administrative decisions remain which will eventually drive the development by DOE of any interim or long-term storage of SNF. Consistent with Commission decisions in previous NDCTPs, PG&E therefore believes it is reasonable to assume a three-year delay in the start date for DOE initiating transfer of commercial SNF – to 2031 from 2028 (as adopted in the 2015 NDCTP). However, PG&E assumes that the DOE will not begin picking up SNF at DCPP until 2038 in light of the DOE's original generator allocation/receipt schedules based upon the oldest fuel receiving the highest priority; information available on the projected rate of transfer; and the backlogged national queue, PG&E assumes that DOE would commence picking up SNF at DCPP in 2038. Different DOE acceptance schedules may result in different completion dates. For purposes of this cost estimate, PG&E has assumed that the DOE will accept already canistered fuel.

Until SNF pickup, it's assumed that supplemental dry cask SNF storage at the DC ISFSI will be used after the plant shutdown for the SNF in the plant's wet storage pools. By relocating the fuel to the ISFSI, DCPP can secure wet storage pools and begin decommissioning the nuclear units. The estimates include costs to expand the ISFSI to accommodate the GTCC waste after pool operations cease and for the long-term caretaking of SNF at the site through the year 2067.

3.6. CONTINGENCY

This section discusses contingency factors as they relate to nuclear decommissioning, the Commission's approval of contingency levels for California utilities in previous NDCTP filings, and PG&E's proposed contingency level for its current DCE.

3.6.1. Definition of Contingency in Nuclear Decommissioning Context

Contingency in the context of forecasting nuclear decommissioning expenditures has a specific meaning: the contingency factor is meant to account for the difference between the base cost and unforeseen, but anticipated, costs. The base cost estimate defines the project scope and accounts for the known and reasonably anticipated costs of decommissioning in the future. The contingency factor accounts for unforeseen costs within the defined activity scope (i.e., events that will occur in the field during the implementation of the overall decommissioning work period and which are not accounted for in the base cost estimate). For example, the mechanical failure of heavy equipment, tool breakage, weather delays, and the flooding of a trench are all known unknown events that increase the cost of decommissioning activities. Such cost increases are deemed to be within the scope of the decommissioning project because they occur during the conduct of an activity that is included in the base estimate. At the same time, they are unforeseeable because no one can predict when equipment will break or when the weather will cause delays (causing rescheduling of activities, inefficiencies in production, loss of productivity, overtime, slippages, etc.).

The events covered under contingency are often characterized as the "known unknowns" that will occur over the duration of a decommissioning project. Contingency factors in this sense reflect only one type of risk – the specific risks of increased costs resulting from conditions at the project site after the commencement of the decommissioning work. Contingency dollars provide assurance that sufficient funding is available to accomplish the intended project scope and are expected to be fully expended during decommissioning. An estimate without contingency, or an inadequate allowance for contingency, can result in significant schedule delays and increased costs associated with delays if the project is unable to proceed. This definition of contingency does not include scope changes, or "unknown unknowns" such as a change in regulatory criteria, significant natural disasters, and security or terrorist activity.

3.6.2. Previous Commission Determination as to the Appropriate Level of Contingency

In the 2005 NDCTP, the Commission directed the California utilities to perform a detailed analysis to develop a conservative contingency factor to be applied to each cost estimate and present the findings in the 2009 NDCTP (Reference 3.15). To comply with the Commission's order, PG&E prepared an analysis titled "Technical Position Paper for Establishing an Appropriate Contingency Factor for Inclusion in the Decommissioning Revenue Requirements" (Technical Position Paper) (Reference 3.16). Based on industry and regulatory documents, the position paper concluded that it is appropriate to apply an overall 25 percent contingency factor to estimated decommissioning costs. Consistent with this recommendation, each of the California utilities used this PG&E paper which proposed, and the Commission found reasonable, a 25 percent contingency factor for DCPP in each of PG&E's subsequent NDCTPs (References 3.17 and 3.18).

This determination of the appropriate decommissioning level was determined at a time when it was expected that decommissioning would not begin until decades in the future. By the time of the 2012 NDCTP Phase 2 decision, Southern California Edison (SCE) had ceased operations at SONGS 2 and 3, but the Commission continued to determine that a 25 percent contingency factor for SONGS 2 and 3 remained appropriate.

Likewise, in evaluating the SONGS 2 and 3 2015 site-specific decommissioning cost estimate proceeding, when SONGS had already completed decommissioning conceptual designs and was initiating decommissioning activities, the Commission again approved an overall 25 percent contingency factor (Reference 3.19). While noting that it would continue to evaluate the appropriate contingency, the Commission approved an overall 25 percent contingency rate for DCPP in the 2015 NDCTP.

3.6.3. Proposed Contingency for Current DCE

PG&E reevaluated current industry and regulatory guidance since the development of the Technical Position Paper to determine whether the previous conclusion that 25 percent is an appropriate contingency factor for nuclear decommissioning costs remains valid. The most recent NRC advice (Reference 3.22) states that:

In general, a contingency of 25 percent applied to the sum of all estimated decommissioning costs should be adequate, but in some cases a higher contingency may be appropriate. The 25 percent contingency factor provides reasonable assurance for unforeseen circumstances that could increase decommissioning costs and should not be reduced or eliminated simply because foreseeable costs are low. Proposals to apply the contingency only to selected components of the cost estimate, or to apply a contingency lower than 25 percent, should be approved only in circumstances when a case-specific review has determined there is an extremely low likelihood of unforeseen increases in the decommissioning costs (e.g., if the decommissioning costs are highly predictable and are established by binding contracts.)

As it has in previous NDCTP filings, PG&E has calculated contingency at the line item level. However, PG&E has not adjusted the overall contingency to 25 percent as the Commission approved in prior NDCTP decisions. Table 3-17 identifies the contingency percentage adapted by PG&E for each line item cost category, with an overall contingency level of 20.6 percent. PG&E believes that this contingency level is appropriate given the current early state of decommissioning.

PG&E will continue to assess applicable project contingency levels in future NDCTPs.

Table 3-17: DCPP Decommissioning Contingency

No.	Cost Category	Contingency Factor
1	Program Management, Oversight, and Fees	13.8%
2	Security Operations	15.0%
3	Waste/Transportation/Material Management (Excluding: Breakwater, Reactor Vessel/Internal Segmentation, & Large Component Removal)	29.8%
4	Power Block Modifications	15.0%
5	Site Infrastructure	15.0%
6	Large Component Removal	25.0%
7	Reactor/Internals Segmentation	43.2%
8	Spent Fuel transfer to ISFSI	15.0%
9	Turbine Building	35.9%
10	Auxiliary Building	23.5%
11	Containment	24.1%
12	Fuel Handling Building	24.3%
14	Balance of Site	18.8%
15	Intake Structure	19.8%
16	Discharge Structure	17.7%
17	Breakwater	25.0%

No.	Cost Category	Contingency Factor
18	Non-ISFSI Site Restoration	19.1%
19	Spent Fuel transfer to DOE	15.0%
20	ISFSI Demolition and Site Restoration	19.6%
	GRAND TOTAL	**20.6%**

4 - COST ESTIMATE

The purpose of this chapter is to provide the details of PG&E's site-specific cost estimate. Section 4.1 and its subsections address all costs to be recovered from the DCPP Nuclear Decommissioning Trust (NDT) (see the summary of costs for each DCE section in Table 4-1 below). Table 1-1 provides the total cost of pre- and post-2025 expenses. Except for costs estimated for pre-shutdown planning activities described in Section 4.1.1.1.1, all costs shown in the DCE include an overall contingency factor of approximately 20.6 percent (see Section 3.6).

4.1. COST CATEGORIES AND METHODOLOGY

Because DCPP decommissioning is a large, complex project that will span decades, it's important to organize the project into manageable sections using standardized project management methods. One such method is use of a work breakdown structure that details scopes of work required, time tables, and cost estimates. Section 4.1 of the DCE is divided into three NRC-defined cost categories (or phases) -- "License Termination" is described in Section 4.1.1, "Spent Fuel Management" is discussed in Section 4.1.2, and "Site Restoration" is detailed in Section 4.1.3. Within each category, costs were estimated by scope of work. The one exception to this breakdown is the power block building demolition costs for the Containment structures, Turbine Building, Auxiliary Building, Fuel Handling Building, and Discharge falling under the License Termination category.

License Termination: Costs that are consistent with "decommissioning" as defined by the NRC in its financial assurance regulations (i.e., 10 CFR 50.75). The cost reported for this category is generally sufficient to terminate the plant's operating licenses, recognizing that spent fuel management represents an additional cost liability that will interact with the license termination effort.

Spent Fuel Management: Costs associated with the containerization and transfer of spent fuel from the SFPs to the DC ISFSI and the transfer of casks from the DC ISFSI to an approved off-site location. Costs also are included for the operations of the SFPs and management of the DC ISFSI until all SNF and GTCC waste is transferred to an approved off-site location.

Site Restoration: Costs associated with the dismantling and demolition of buildings and facilities demonstrated to be free from radiological contamination. This includes structures never exposed to radioactive materials (such as office buildings), as well as those facilities that have been decontaminated to appropriate levels (such as the Turbine Building). Structures are removed to a depth of three feet (unless noted otherwise) and backfilled to conform to local grade.

The costs assigned to the three major categories are allocations. Cost elements are designated to enable comparison (e.g., with NRC financial guidelines) or to permit specific financial treatment (e.g., Asset Retirement Obligation determinations). In reality, there may be considerable interaction among the activities in the three subcategories. For example, an owner may decide to remove non-contaminated structures early in the project to improve access to contaminated facilities or plant components. However, in general, the allocations represent a reasonable accounting of those costs that can be expected to be incurred for the specific subcomponents of the total estimated program cost, if executed as described.

Table 4-1: Summary of DCE Sections and Cost Breakdowns

DCE Section	DCE Section Title	License Termination	Spent Fuel Management	Site Restoration	Grand Total
		(in thousands)			
4.1.1.1	Pre-Work and Planning	48,587			48,587
4.1.1.2	Decommissioning Preps/Plant Modifications	246,310			246,310
4.1.1.3	Decontamination	74,482			74,482
4.1.1.4	Reactor Vessel Internals and Dismantling	332,341			332,341
4.1.1.5	GTCC Management	40,937			40,937
4.1.1.6	Large Components, Systems, and Area Dismantling	375,419			375,419
4.1.1.7	Waste Management, Transportation and Burial	703,330			703,330
4.1.1.8	Materials Management	10,392			10,392
4.1.1.9	Support Services	1,002,888			1,002,888
4.1.2.1	Fuel Pool Operations		864		864
4.1.2.2	ISFSI Management		138,567		138,567
4.1.2.3	Spent Fuel Transfer Operations		203,521		203,521
4.1.2.4	Waste Management, Transportation and Burial		20,532		20,532
4.1.2.5	Materials Management		4,211		4,211
4.1.2.6	Support Services (Excl. Security)		219,171		219,171
4.1.2.6	Support Services (Security)		545,030		545,030
4.1.2.7	GTCC Management		40,696		40,696
4.1.3.1	Balance of Site Restoration			135,075	135,075
4.1.3.2	Building Demolition	93,680		229,606	323,286
4.1.3.3	Waste Management, Transportation and Burial			243,104	243,104
4.1.3.4	Materials Management			-16,443	-16,443
4.1.3.5	Support Services			110,096	110,096
Grand Total		**$2,928,365**	**$1,172,592**	**$701,438**	**$4,802,395**

4.1.1. NRC License Termination

4.1.1.1. Pre-Work and Planning

4.1.1.1.1. Pre-Shutdown Planning

PG&E's early planning is designed to create a road map to transition from an operating plant to a decommissioning site. This section provides the costs incurred or estimated for the following:

- PPP
- DCE Development
- 2019-2024 Planning

As discussed in Section 2.1, PG&E first prepared a PPP to delineate the decommissioning planning process that will occur during the five to eight years before Unit 1 is permanently shutdown.

As discussed in Section 2.2, PG&E used the process recommended in the PPP to develop this site-specific DCE. Table 4-2 provides a breakdown of the costs.

Table 4-2: Costs to Prepare Site Specific Decommissioning Cost Estimate

	PG&E Labor	Outside Labor	Other
	(in thousands)		
Site Specific Decommissioning Cost Estimate	$10,066	$17,899	$353

PG&E will request disbursement from the DCPP NDT up to the initial 3 percent allowed by the NRC for radiological decommissioning planning costs. For DCPP Units 1 and 2, the total amount available for decommissioning planning is $37.2 million.

2019-2024 Planning Costs

This subsection identifies costs included in the DCE for planning activities that PG&E proposes to perform prior to shutdown; these costs are not included in the amounts used to calculate the revenue requirement to fund the DCPP NDT and are estimated to be $187.8 million. This cost estimate far exceeds the $37.2 million that may currently be withdrawn from the NDT for pre-shutdown decommissioning planning activities. Nonetheless, as discussed in Section 1.5, direct transition to decommissioning is in the best interest of PG&E's customers. The cost difference results from the fact that costs continue to be incurred while waiting to obtain license revisions and permits, and for developing engineering designs, work plans, procedures, and procuring equipment. By completing these activities from 2019 to 2024 before decommissioning starts, PG&E can save money by minimizing the transition period. Table 4-3 shows the estimated savings from performing these planning activities prior to shutdown.

Table 4-4 outlines the costs associated with the planning and long lead procurement prior to Unit 1 shutdown. The table shows the costs by the Milestones, subprojects, and activities outlined in Section 6.1as they relate to the three major cost categories and their associated work scopes described in this chapter. For example, the Site Infrastructure planning and procurement prior to shutdown are described in Section 4.1.1.2 (License Termination) and the Balance of Site Demolition planning is described in Section 4.1.3.2 (Site Restoration).

Table 4-3: Estimated Savings from Conducting DCPP Decommissioning Pre-Planning

			Cost Avoidance[2]	
	Activity/Cost Type	**Impacted Categories**	**Potential Cost Avoidance (thousands 2017 $)**	**Guiding Principles**
Long Lead Work	SFPI	Operations, Maintenance, Security Requirements Staffing, and Safety		Safe Implementation of Project
Long Lead Work	Cold & Dark	Operations, Maintenance Requirements Staffing, and Safety		Safe Implementation of Project
Long Lead Work	Reactor Pressure Vessel and Internals Technical Evaluation	Potential risk to project critical path		Minimizing Dose, Safe Implementation of Project, and Schedule Optimization
Long Lead Work	Security Modifications	Security Requirements Staffing	$9,332	Reduce Decommissioning Costs and Ratepayer Impacts
Long Lead Work	GTCC/ISFSI Pad Expansion	Potential risk to project critical path due to licensing and design basis, permitting and licensing updates needs to be executed concurrent with Expedited Spent Fuel work		Schedule Optimization and Reduce Decommissioning Costs and Ratepayer Impacts
Long Lead Work	Expedited Spent Fuel [1]	1) Security Requirements Staffing 2) Potential risk to project critical path 3) Schedule Optimization	Supports 2018 NDCTP Filing and CPUC Request	Schedule Optimization, Reduce Decommissioning Costs and Ratepayer Impacts, Compliance with CPUC ALJ decision in 2015 NDCTP Application

			Cost Avoidance[2]	Guiding Principles
	Activity/Cost Type	Impacted Categories	Potential Cost Avoidance (thousands 2017 $)	
Permitting	Permitting Agency Applications and Fees	1) Security Requirements Staffing 2) Potential risk to project critical path 3) Schedule Optimization	$156,732	Schedule Optimization, Reduce Decommissioning Costs and Ratepayer Impacts, Maintaining compliance with all federal, state, and local regulatory and legal requirements
Licensing	License Amendment Requests and NRC Processing Fees	1) Security Requirements Staffing 2) Potential risk to project critical path 3) Schedule Optimization		Schedule Optimization, Reduce Decommissioning Costs and Ratepayer Impacts, Maintaining compliance with all federal, state, and local regulatory and legal requirements
Project Staff	Project Management / Staff / Technical Reviews	1) Safety 2) Security Requirements Staffing 3) Potential risk to project critical path 4) Schedule Optimization	Corresponding cost savings in NRC License Amendment	Safe Implementation of Project, Schedule Optimization, Reduce Decommissioning Costs and Ratepayer Impacts, Maintaining compliance with all federal, state, and local regulatory and legal requirements
	Total		**$166,064**	

1. Per ALJ decision on 2015 NDCTP application
2. Cost avoidance incurs extension of approximately 2 years to critical path with higher than planned staffing levels due to challenges in meeting licensing and permitting milestones to begin implementation and execution work.

Table 4-4: 2019-2024 Pre-Shutdown Planning Cost Estimate Summary

Reasonableness Comparison	DCE Section	Pre 2019	2019	2020	2021	2022	2023	2024	Total
1 - Program Management, Oversight, and Fees		**28,936**	**15,961**	**19,437**	**21,793**	**20,666**	**20,563**	**27,482**	**154,837**
1.01 - Staffing	4.1.1.1 - Pre-Work & Planning	22,820	479	-	-	-	-	-	23,299
1.01 - Staffing	4.1.1.9 - Support Services	-	9,673	11,562	11,936	12,780	11,898	15,481	73,330
1.01 - Staffing	4.1.2.6 - Support Services	3,537	205	238	394	445	445	1,038	6,303
1.01 - Staffing	4.1.3.5 - Support Services	2,578	696	1,063	1,249	1,478	1,478	1,596	10,139
1.06 - NRC Fees / Reviews	4.1.1.9 - Support Services	-	250	3,680	3,934	2,182	1,923	1,607	13,576
1.1 - Permits	4.1.1.9 - Support Services	-	1,663	797	1,437	1,227	1,302	2,329	8,754
1.1 - Permits	4.1.2.6 - Support Services	-	370	177	319	273	289	517	1,945
1.1 - Permits	4.1.3.5 - Support Services	-	1,663	797	1,437	1,227	1,302	2,329	8,754
1.11 - Future Land Use	4.1.3.5 - Support Services	-	962	823	787	754	1,626	2,278	7,229
1.12 - Spent Fuel Management Plan	4.1.1.5 - GTCC Management	-	-	-	-	-	-	4	4
1.12 - Spent Fuel Management Plan	4.1.2.2 - ISFSI Management	-	-	-	-	-	-	53	53
1.18 - Public Outreach & Stakeholder Engagement	4.1.1.9 - Support Services	-	-	300	300	300	300	250	1,450
3 – Waste / Transportation / Material Management		**-**	**-**	**-**	**-**	**-**	**-**	**892**	**892**
3.04 - Material Management	4.1.3.4 - Materials Management	-	-	-	-	-	-	892	892
4 - Site Infrastructure		**-**	**-**	**-**	**-**	**2,158**	**9,434**	**8,059**	**19,651**
4.01 - U1 Spent Fuel Pool Island	4.1.1.2 - Decommissioning Preps/Plant Modifications	-	-	-	-	-	879	990	1,869
4.02 - U2 Spent Fuel Pool Island	4.1.1.2 - Decommissioning Preps/Plant Modifications	-	-	-	-	-	508	528	1,036

Reasonableness Comparison	DCE Section	Pre 2019	2019	2020	2021	2022	2023	2024	Total
4.03 - Install 230kV Baywood Feed	4.1.1.2 - Decommissioning Preps/Plant Modifications	-	-	-	-	-	2,703	1,855	4,558
4.04 - U1 Cold and Dark	4.1.1.2 - Decommissioning Preps/Plant Modifications	-	-	-	-	-	1,800	1,456	3,257
4.05 - U2 Cold and Dark	4.1.1.2 - Decommissioning Preps/Plant Modifications	-	-	-	-	-	1,800	1,456	3,257
4.06 - Security Modifications	4.1.1.2 - Decommissioning Preps/Plant Modifications	-	-	-	-	2,158	1,744	1,773	5,674
5 - Site Infrastructure		**-**	**565**	**2,402**	**3,225**	**105**	**4**	**694**	**6,995**
5.03 - Facility Construction	4.1.1.2 - Decommissioning Preps/Plant Modifications	-	-	-	-	-	4	175	179
5.06 - ISFSI Pad Expansion for GTCC Storage	4.1.1.5 - GTCC Management	-	565	2,402	3,225	105	-	-	6,297
5.07 - Project Oversight and Support	4.1.1.2 - Decommissioning Preps/Plant Modifications	-	-	-	-	-	-	519	519
7 - Reactor / Internals Segmentation		**-**	**-**	**-**	**1,350**	**-**	**-**	**-**	**1,350**
7.06 - Project Oversight and Support	4.1.1.4 - Reactor Vessel Internals and Dismantling	-	-	-	1,350	-	-	-	1,350
14 - Balance of Site		**-**	**-**	**-**	**-**	**-**	**2,019**	**2,104**	**4,123**
14.03 - Demolition	4.1.3.2 - Building Demolition	-	-	-	-	-	2,019	2,104	4,123
Grand Total		**28,936**	**16,526**	**21,840**	**26,368**	**22,928**	**32,020**	**39,231**	**187,848**

Licensing

It can take several years to develop, submit, and obtain approval from the NRC for license submittals. By obtaining NRC approvals prior to final shutdown, PG&E will be able to execute approved changes immediately after meeting the conditions to begin a specific decommissioning phase instead of taking several months or years to develop and issue documentation for the changes. The cost estimate includes funding for developing, submitting, and obtaining NRC review and approval of licensing submittals. The scope of licensing submittals assumes the federal rulemaking associated with decommissioning[8] will be issued as outlined in May 2018 in the Draft Federal Register Notice. This results in a reduced number of submittals to the NRC as compared to current federal regulations, resulting in cost savings.

Permitting and Future Land Use

An overview of the permitting necessary to support decommissioning is provided in Section 3.1. Like licensing submittals, permits can take several years to develop, submit, and obtain approval from an agency. By obtaining permitting approvals prior to final shutdown, PG&E will be able to initiate physical work activities soon after final shutdown. The cost estimate includes funding for (1) developing, submitting, and obtaining state and local agency reviews and approvals of permitting submittals and (2) evaluating options for future land uses of the DCPP lands. The future uses of the DCPP lands will inform permit applications.

Engagement Panel

Decommissioning will be a long and complex process requiring the balancing of many interests. In its decision approving DCPP's retirement, the Commission ordered that "[PG&E] will take no action with respect to any of the lands and facilities, whether owned by the utility or a subsidiary, before completion of a future process including a public stakeholder process; there will be local input and further Commission review prior to the disposition of DCPP facilities and surrounding lands."[9] In compliance with this order, PG&E has convened an external stakeholder group – the DCDEP – in order to engage in open and transparent dialogue with all interested stakeholders on matters regarding decommissioning and future use of the lands around DCPP. The panel functions as a volunteer-based, non-regulatory body to enhance and foster open communication, public involvement, and education on PG&E's DCPP decommissioning and future land use plans.

[8] See Docket No. NRC-2015-0070, "Regulatory Improvements for Power Reactors Transitioning to Decommissioning."
[9] D.18-01-22, Ordering Paragraph 13.

Panel members are volunteers and are not paid by PG&E or otherwise compensated for their time. The only costs associated with the DCDEP are administrative, including fees for meeting spaces, meeting supplies and logistics, a meeting facilitator, and the cost of personnel to support the DCDEP.

Security Modifications

PG&E intends to implement security modifications that will improve efficiency and, ultimately, enable security staff reductions while still maintaining a robust decommissioning defense strategy. The planned security modifications (see Section 4.1.1.2.3) require design (including revisions to calculations and drawings), licensing, procurement, and planning. Completion of these efforts prior to final shutdown will allow for immediate implementation after final shutdown. The cost estimate includes funding for preparations to support installation activities after final plant shutdown.

Spent Fuel Pool Island

Several existing plant systems are used to ensure that the SFPs are adequately cooled. These existing systems could continue to be used for SFP cooling during decommissioning; however, to facilitate efficient decommissioning, the nuclear industry has implemented the SFPI concept. A SFPI involves design and installation of an independent cooling system for the SFPs that allows for abandonment of existing plant systems that currently support SFP cooling. PG&E intends to install an SFPI to reduce the risk of decommissioning activities impacting the SFPs. Implementation of the SFPI (see details in Section 4.1.1.2.1) requires design (including revisions to calculations and drawings), licensing, procurement, and planning. Completion of these efforts prior to final shutdown will allow for immediate implementation after final shutdown. The cost estimate includes funding for preparations to support installation activities after final plant shutdown.

Cold and Dark Power

Perhaps the most significant safety hazard associated with decommissioning power plants is the risk posed by personnel and equipment coming in direct contact with exposed and energized electrical circuits. Industry operating experience indicates that even a robust electrical clearance program is insufficient at managing risks associated with electrical shock or arc flash events in power plants being decommissioned and demolished. The most effective way to manage these risks is to remove or disconnect the original power supplies from structures and components before demolition begins. This necessitates the installation of an alternate external power supply (fed from the PG&E local distribution system in the Los Osos Valley -- the Baywood Feed) to support decommissioning work and for selected power plant loads and lighting. This alternate power supply, referred to as Cold and Dark (C&D) power is independent of the normal plant power supply and distribution system. Implementation of C&D power (see details in Section 4.1.1.2.1) requires design (including revisions to calculations and drawings), licensing, procurement, and planning. Completion of these efforts prior to final shutdown will allow for immediate implementation after final shutdown. The cost estimate includes funding for preparations to support installation activities after final plant shutdown.

Planning, Management, Project Staff, and Technical Analyses

The cost estimate for pre-shutdown planning includes funding to perform an initial radiological characterization of the DCPP site to inform the plan for conducting FSSs (see details in Section 2.3); procuring equipment/material for site infrastructure modifications (see details in Section 4.1.1.2.2); conducting technical analyses required to support the decommissioning planning that are beyond the capacity and/or capability of the requested decommissioning project staff (e.g., analysis for transportation of the RPV and internals waste); and general Decommissioning Project staffing (i.e., Project Controls, Radiation Protection, Safety and Health, Security and Emergency Services, Support Staff, and Transition Management).

4.1.1.1.2. Transition from Operations to Decommissioning

The tasks performed to maintain plant safety differ between operating and permanently shutdown conditions. The transition period for DCPP, an operating plant that has planned decommissioning intended to commence upon unit shutdown, overlaps the pre and post shutdown periods. When the plant is operating, plant systems -- staff needed to safely operate and maintain systems -- far exceed the plant systems and staff needed for a permanently shutdown site. During operations, water is heated, moved through closed systems to produce steam, and then used to spin turbines to produce electricity. A permanently shutdown facility no longer needs most of the systems used to generate electricity and maintaining those systems after permanent shutdown is expensive and unnecessary. However, before abandoning the systems, plant staff must empty, clean, drain, and lay-up the systems to ensure that the hardware is left in a safe condition. The purpose of post-shutdown activities is to reduce potential hazards to employees and the environment from unintentional leaks, electrical shock, or component failure. The effort includes removing and disposing of oils, draining water from tanks and pipes, moving the spent nuclear fuel from the reactor to the SFP, and de-energizing components that aren’t needed.

The number and type of employees needed to safely operate a plant is also significantly more than that needed after shutdown. During the transition period, staffing levels will correlate to the amount and complexity of work performed. As the transition proceeds, both the amount and complexity of the work will decrease, and so will staffing. Planning for these staffing changes will begin about 10 months ahead of Unit 1 shutdown.

The decommissioning transition will start with the planning for final shutdown of Unit 1 in early 2024 and will continue until after final defueling of Unit 2 and draining or de-energizing un-needed systems in about August 2026. By starting the planning process prior to Unit 1 final shutdown, PG&E can develop a safe and cost-effective transition of both employees and plant systems in preparation for active decommissioning. The transition planning process defines and schedules work scope; determines the staffing and support needed to execute the scope; and prepares the employees for their transition before, during, and after the transition. Work planning for this transition period is discussed in more detail in Section 4.1.1.1.1. The transition work will include:

- Taking the units offline
- Cooling down the reactor coolant systems
- Defueling the reactors
- Reinstalling the reactor vessel heads
- Draining oils and hydraulic fluids from systems that are no longer needed
- Disposing of the used oils and hydraulic fluids
- Draining and processing water from pipes and tanks
- Disposing of processed water
- Tagging and lock-out of unneeded electrical components

Non-labor costs of the decommissioning transition include Waste Management and Transportation (Section 4.1.1.7) and Specialty Contracts (Section 4.1.1.9.14).

Staffing needed to accomplish transitional tasks is a mix of operations, maintenance, engineering, security, and radiation protection disciplines. At Unit 1 shutdown, transition staffing will increase. Most of the additional staff members will be reassigned from the operating unit, including:

- Security personnel
- Maintenance personnel
- Operations personnel

The cost of staffing for the transition period is presented in Section 4.1.1.9.

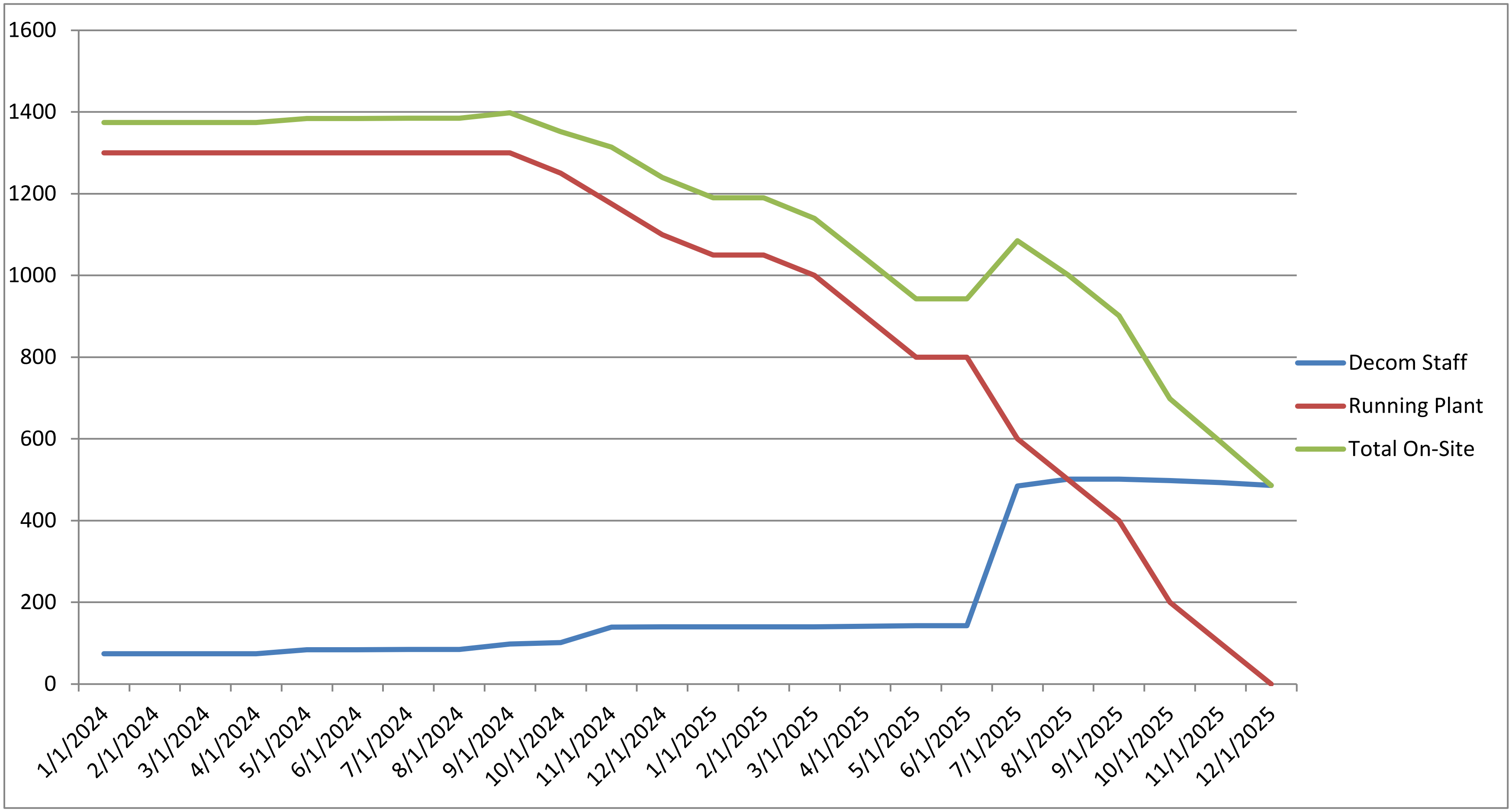
As transition efforts finish, the initial transition team will be reassigned or released. Security personnel will remain with the security organization and gain new assignments; the maintenance staff will be reduced; and the operations personnel will either be absorbed to fill vacant positions in the control room or released.

The transitioning of employees will:

- Ensure that adequate numbers and distribution of disciplines are maintained to adequately staff the needed positions to safely operate, maintain, and transition the plant to a permanent shutdown condition
- Transition PG&E personnel from their current operating positions to their post-shutdown assignments, whether those assignments are with PG&E or elsewhere
- Reduce the overhead and support staffing to minimize unnecessary costs

At the beginning of the transition, there will be two categories of employees: (1) those assigned to continue to operate and maintain the units, and (2) those assigned to decommissioning. All employees assigned to operate and maintain the units will be reassigned or released so that, by the end of the transition, only employees assigned to decommissioning will remain. Conceptually, the transition ramp-up/ramp-down curve should follow the general layout as depicted in Figure 4-1.

Figure 4-1: Decommissioning versus Operating Staffing Levels During Transition



For clarity, Figure 4-1 identifies staffing through the transition period. The “Decommissioning” line in the figure represents the staff assigned to the decommissioning organization whose costs are paid for by the NDT. The “Operation” line in the figure represents the staff who support the operation of the units prior to final shutdown whose costs are paid for by other sources. After Unit 2 is shut down and fuel is permanently removed from the reactor (about January 1, 2026), all remaining staff costs will be recovered from the NDT.

The Staffing Plan contains a detailed discussion for reducing overhead staffing costs in a post-shutdown condition. In summary, there are approximately 1,400 PG&E employees who operate and maintain the two units while operating. During the transition period from November 2024 through mid-2026, some of those positions will be reassigned to decommissioning positions. The decommissioning positions will increase from about 55 in January 2023 to a peak of about 200 non-security personnel at Unit 2 shutdown. The total site staffing shortly after shutdown will be reduced to less than 500 and will generally continue to decline until January 2026, when all personnel filling operating condition (non-decommissioning) positions will have transitioned to their post-shutdown assignments.

4.1.1.1.3. Work Planning

Work planning is the effort that results in the specifics plans, work packages, and selection of equipment needed to perform the physical activities in and around the plant. Work Planning differs from Pre-Project Planning in that Pre-Project Planning created a road map to develop an executable site-specific DCE while work planning provides the “how to” documentation for decommissioning itself.

The DCPP decommissioning project is expected to take many years to complete safely. Since the general sequence of activities is known, some work planning may begin ahead of plant shutdown. For example, many of the tasks associated with the decommissioning transition have been performed for years by plant staff during refueling outages and are well-known (e.g., reactor head removal, moving fuel). Work planning for the transition should begin prior to Unit 1 shutdown so that the work packages are ready and approved to begin as soon as it is safe to do so after the unit is shutdown. Funding for work prior to Unit 1 shutdown is noted in Section 4.1.1.1.

The work planning effort requires the involvement of many disciplines including work planners, schedulers, engineers, licensing specialists, and those involved in radiation protection, safety, procurement, and records management.

Work planners will be assigned to develop work packages for the decommissioning transition period and for routine maintenance. They also will be the “second checkers” for vendor-supplied packages to ensure that the documentation meets the requirements imposed by PG&E and applicable regulations and permits.

Project Control Schedulers will be responsible for compiling and maintaining the decommissioning schedule as described in Section 4.1.1.9.2.

Engineering staff will support a wide range of activities including the work planning efforts, project management plan development, design change reviews, transition planning, ISFSI and security upgrades, and site restoration planning. Engineering staffing is costs are noted in Section 4.1.1.9.3.

The "right timing" of start dates for each discipline is critical for the cost-effective completion of planning. The basis for determining start dates for each position is the executable schedule developed during the Pre-Project Planning period. The planning time for each project is well understood. The start dates for the planning portion are early enough to assure an on-time start to field work. Care was taken in determining the start time to ensure that the planning completion would be both on-time and not too early.

As part of the work planning process, several scope areas are closely scrutinized to determine the best group to plan and execute discrete and complex projects. The scopes identified include:

- RPV segmentation
- ISFSI modifications
- Civil works
- Cold and Dark
- SFPI modifications

4.1.1.1.4. Site Characterization

The 750-acre industrial portion of the DCPP site will be characterized for both radiological contamination and non-radiological contaminants of concern. The purpose of the SCS is, through the formal Data Quality Objectives (DQO) process, to determine the extent and nature of radiological and non-radiological contamination that may exist at DCPP.

Radiological characterization will be conducted in accordance with NUREG-1575, MARSSIM.

The DCPP site will be divided into nine study areas to support an efficient historical review process. The following are the types of processes that will be used in the SCS:

- Grab sample techniques for surface soils
- Soil boring for subsurface soils
- Coring for volumetric concrete samples
- Smear techniques for loose surface contamination
- Direct radiation measurements

- Gamma radiation spectroscopy
- Liquid scintillation counting for tritium analysis
- Radiochemical analysis for hard-to-detect species such as iron-55 and nickel-63

The NRC has defined areas for release under 10 CFR 20.1402 for unrestricted use at a level of exposure to an individual at 25 mrem per year. The value of 25 mrem per year is calculated using a site-specific derived concentration guideline level (DCGL).

Based on the results of sampling, historical record review, and personnel interviews, the nine study areas will be classified by category:

- Non-impacted area: Areas where there is no reasonable process for residual contamination. Non-impacted areas are typically outside the power block PA and may be used as background reference areas.
- Impacted area: Any area that is not classified as non-impacted. These are areas with a possibility of containing residual radioactivity that exceed natural background or fallout levels. To the extent possible, all impacted areas at the DCPP site will be preliminarily classified as Class 1, 2, or 3 as described in NUREG-1575. The preliminary MARSSIM classifications will be based on the following definitions:
    - ☐ Class 1 Area: Impacted areas that have, or had prior remediation, a potential for radioactive contamination (based on site operating history) or known contamination (based on previous radiological surveys) above the anticipated derived concentration guideline level (DCGL), or insufficient historical information and data are available to justify a Class 2 or Class 3 designation
    - ☐ Class 2 Area: Impacted areas that have a potential for radioactive contamination or known contamination, but are not expected to exceed the anticipated DCGL
    - ☐ Class 3 Area: Impacted areas that are not expected to contain any residual radioactivity, or are expected to contain levels of residual radioactivity at a small fraction of the anticipated DCGL, based on site operating history and previous radiological surveys

There are several sources of non-radiological contamination at the DCPP site. Examples of non-radiological contamination include:

- During construction, some materials used were not considered hazardous but have since been deemed hazardous.
- Hazardous materials in equipment and instrumentation
- Spills and leaks of hazardous materials

Historically, many building materials used in industrial construction contained chemical constituents now considered hazardous. Examples of materials and chemicals of concern include:

- Paints containing lead or PCBs
- Asbestos-containing materials in floors, windows, and building siding
- Treated wood

In addition to hazardous materials contained in components or construction, the characterization study will evaluate DCPP for spills or releases of petroleum-based products and industrial chemicals used throughout the site.

Non-radiological characterization, like radiological characterization, will divide the site into nine study areas. The following are examples of non-radiological processes that will be used for the SCS:

- Grab sample techniques for surface soil
- Soil boring techniques for subsurface soil
- Volumetric samples for hazardous materials analysis
- Scrape samples for coatings analysis

Based on the results of sampling, historical record review, and personnel interviews, the nine study areas will be classified as non-radiologically contaminated or contaminated with chemicals of concern.

A HAS was performed based on historical operating record review, personnel interviews, and documented spills or events in the corrective action program. The 10 CFR 50.75 g file for documenting contamination events is maintained as a live file. A combination of corrective action program review, record review, and personnel interviews will be conducted from 2018 to 2024 before the physical characterization work begins. A characterization sampling plan will be developed from the HSA. Physical sampling and analysis will occur after Unit 1 and Unit 2 are shut down. For any characterization sampling that occurs within the coastal zone, consultation and/or permitting will be required from the:

- CCC
- USACE
- San Luis Obispo County

The risks and challenges associated with SCS include the following categories:

- Regulatory change
- Significant characterization-affecting event is missed
- Inaccurate data produced
- Unexpected conditions are encountered
- Changing conditions

Specifically, non-impacted areas may change if radiological events or spills occur in or affect areas during the remainder of the operational years. In addition, preliminary MARSSIM classifications criteria corresponding to 25 mrem per year may change if the final approved DCPP site release criteria are based on a lower annual dose.

In its benchmarking of the decommissioning industry, PG&E found that several plants identified asbestos containing materials, lead, and PCBs in facility systems and buildings. Managing and disposal of unanticipated quantities of these types of materials can lead to cost increases and schedule delays associated with sampling and characterization. For example, at Yankee Rowe Nuclear Power Station discovered approximately three times the estimated volume of PCB in soils and sediment during decommissioning. As a result, additional costs were incurred to perform on-site treatment of soils and sediment. At the Big Rock Point Nuclear Plant in Michigan, all potential wastes were surveyed and characterized as early as possible. The appropriate characterization at Big Rock Point for lead based materials, PCB wastes, and asbestos containing materials resulted in increases in disposal costs for hazardous materials over the estimated dollar amounts.

The SCS team will follow the guidance in NUREG-1575 for completing the radiological characterization. All non-radiological hazardous characterization will be in accordance with both federal and California EPA standards.

One overarching purpose of a thorough and accurate SCS is the health and safety of the public, PG&E employees, and contract personnel. An accurate and thorough site characterization also will minimize the environmental impact from plant operations.

4.1.1.1.5. License Termination Plan

Three NRC-issued licenses pertain to DCPP: (1) two issued under Part 50 for the operation of each reactor unit; and (2) one site-specific license issued under Part 72 for the storage of spent nuclear fuel and operation of the DC ISFSI. Once the plant is decommissioned, PG&E will petition the NRC to terminate the Part 50 licenses. The LTP must be submitted at least two years prior to the anticipated date of license termination. The LTP provides the NRC the information needed to determine whether to terminate the Unit 1 and Unit 2 Part 50 licenses.

To prepare the LTP, specific documents must be completed, including the updated DSAR, Site Characterization Plan, Site Remediation Plan, Final Site Survey Plan, Updated Site-Specific Decommissioning Cost Estimate, and Supplement to the Environmental Plan. Preparation of the Part 50 LTP should begin well before all the spent fuel has been transferred to the ISFSI (estimated date 2032). Major LTP preparation work should begin about two years before PG&E plans to submit it to the NRC for approval. Submitting the LTP for NRC approval later in the decommissioning process maximizes the amount of decommissioning work that can be conducted under the more flexible controls of the DCPP

PSDAR. If the Part 50 LTP is submitted later, when the decommissioning work is well along or nearing completion, there would be fewer biennial updates to the LTP.

The LTP will include the following information pursuant to 10 CFR 50.82 and NUREG-1700 requirements:

- *Historical Background and Site Description:* Historical background of the facility, a brief description of the Site and immediate environs, a brief description of any changes to the original site boundary, and a summary of the license activities that have occurred at the site
- *Decommissioning Approach/Objective*: Description of the decommissioning approach and key objectives.
- *LTP Scope/Summary:* The LTP must address each of the areas delineated in 10 CFR 50.82(a)(9) as well as Subpart E of 10 CFR Part 20
- *Site Characterization:* Determination of the extent and range of radioactive contamination on site, including structures, systems, components, residues, soils, and surface and groundwater
- *Identification of Decommissioning Activities:* Description of the dismantlement and decontamination activities, including areas requiring remediation, radiological conditions, estimates of occupation radiation dose, estimate of radioactive material to be shipped for disposal, and control mechanisms to ensure remediated areas are not re-contaminated
- *Site Remediation Plans:* Remediation techniques that may be used to reduce the residual contamination to levels that comply with the unrestricted release criteria of 10 CFR 20, Subpart E
- *Final Status Survey Plan*: Process that will be used to verify the DCPP Unit 1 and Unit 2 sites will comply with the 10 CFR 20 criteria for unrestricted use. The LTP describes the final Radiation Survey Plan as specified in 10 CFR 50.82(a)(9)(ii)(D) and 10 CFR 20.1501(a) and (b). The FSS are performed to demonstrate that an area conforms to the radiological release criteria for license termination.
- *Compliance with Radiological Criteria for License Termination:* The radiological criteria proposed for license termination are for unrestricted release in accordance with the requirements of 10 CFR 20.1402.
- *Update of the Site-Specific Decommissioning Costs:* Estimate of the remaining decommissioning costs for unrestricted or restricted release of the site.
- *Supplement to the Environmental Report:* A supplement to the Environmental Report that describes any new information or significant environmental changes associated with the site-specific termination activities
- *Released facilities or site areas:* Identification of parts, if any, of the facility or site that were released for use before approval of the LTP

PG&E will submit the LTP as a supplement to the FSAR or its equivalent; in accordance with 10 CFR 50.82(a)(9), it must submit the LTP at least two years prior to the anticipated date of license termination. The NRC must issue a license amendment when it approves the LTP and must hold a public meeting near the site. PG&E plans to submit the LTP to the NRC after both DCPP Units 1 and 2 are shut down, defueling is completed, and all spent fuel has been transferred to the ISFSI. This approach will allow for a more simplified hearing process in accordance with 10 CFR 2, Subpart L.

The NRC will notice the receipt of the LTP in the Federal Register, make the LTP available for public comment, and schedule a local hearing. NRC staff will inspect the site during decommissioning to ensure compliance with the approved LTP. These inspections will normally include in-process and confirmatory radiological surveys. The NRC will terminate the Part 50 licenses if it determines that site remediation has been performed in accordance with the LTP and that the terminal radiation survey and associated documentation demonstrate the site is suitable for release.

The planning costs will consist of plan development and overhead staffing costs. The costs incurred directly by LTP include:

- Preparation of the LTP, which will involve developing the information noted above. The following plans/studies being prepared and costed separately will be reviewed, confirmed, and incorporated:
  - ☐ Historical Background and Site Description
  - ☐ Site Characterization (See Section 4.1.1.1.4)
  - ☐ Site Remediation Plans (See Section 4.1.3.1.1)
  - ☐ Final Status Survey Plan (See Section 4.1.3.1.2)
  - ☐ Update of the Site-Specific Decommissioning Costs
  - ☐ Supplement to the Environmental Report (See Section 4.1.1.1.5)
- Staffing
  - ☐ Submittal of the LTP to the NRC
  - ☐ Coordination with the NRC staff and NRC billable costs associated with their review
  - ☐ Submittal of FSS results
  - ☐ Attending hearings

Planning costs also will be incurred for the ISFSI PRDP. These costs include:

- Preparation of the PRDP
- Staffing
  - ☐ Submittal of the PRDP to the NRC
  - ☐ Coordination with the NRC staff and NRC billable costs associated with their review
  - ☐ Submittal of FSS results
  - ☐ Attending hearings

The total direct LTP cost estimate is shown in Table 4-5 with contingency.

Table 4-5: License Termination Plan Costs

	Labor	Material	Other	Grand Total
	(in thousands)			
License Termination Plan Costs	$13,450	$569	$188	$14,207

4.1.1.2. Decommissioning Preparations / Plant Modifications

4.1.1.2.1. Power Block Modifications

The power block consists of the Containment Buildings, Fuel Handling Building (FHB), Turbine Building, Auxiliary Building, and Radwaste Building. Following reactor shutdown and final defueling of the reactor vessel, several modifications within the power block are needed to support employee safety during decommissioning as well as safe and reliable cooling of the spent fuel in the SFPs. These include developing alternative power sources (C&D Power Plant modifications); arranging for long-term decommissioning power sources; and SFPI modifications.

<u>Modifications to Implement Cold and Dark Power Plan</u>

Perhaps the most significant safety hazard associated with decommissioning power plants is the risk posed by personnel and equipment coming in direct contact with exposed and energized electrical circuits. Industry operating experience indicates that even a robust electrical clearance program may be insufficient at managing risks associated with electrical shock or arc flash events in power plants being decommissioned and demolished. The most effective way to manage these risks is to remove or disconnect the original power supplies from structures and components before starting demolition. This requires installing an alternate external power supply to support decommissioning work and for selected power plant loads and lighting. This alternate power supply, referred to as C&D power, is independent of the normal plant power supply and distribution system. The C&D electrical load centers will be installed external to and separated from all other site structures. Alternate, temporary, power feeds from the C&D system will be installed and clearly identified as part of the energized C&D electrical system.

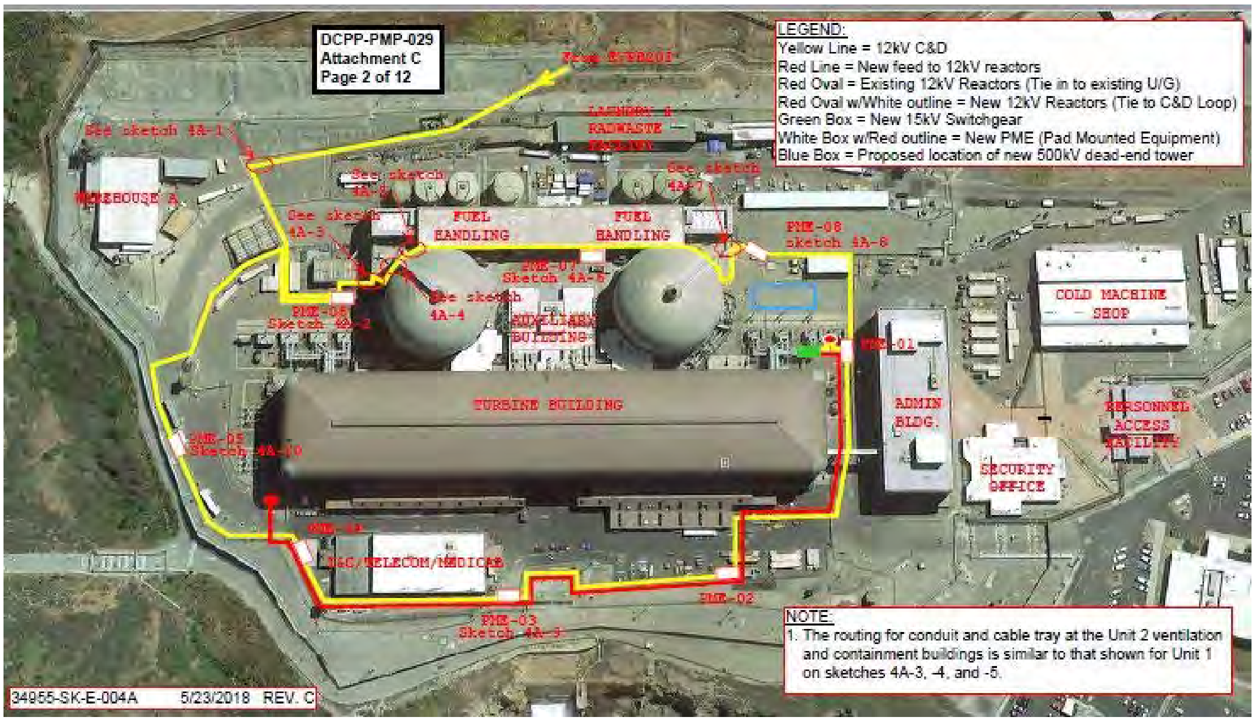
Because reliable electrical power is essential to effectively plan and execute nearly every decommissioning activity, it is critical that the C&D system be deployed as timely as possible to prevent disruptions during decommissioning caused by power outages. The transition to C&D requires coordination with and work by both the PG&E Electrical Transmission and Distribution groups, so it is essential that sufficient long-term planning work be completed prior to shutdown (see details in Section 4.1.1.1.1).

Once implemented, the C&D power system (see Figure 4-2) will continue to evolve along with the demands for electrical power to support decommissioning activities. Initially, at least two independent power supplies will be preserved to ensure reliable cooling of the SFPs. The original existing electrical sources will meet this requirement. Those sources are the 230-kV and the 500-kV power lines, along with the existing backup emergency generators. When the heat loads in the SFPs have diminished sufficiently to allow plant personnel to prevent a zirconium fire, a series of modifications will be undertaken to transition the power feeds for the C&D systems to two new load centers outside of the power block. Those load centers will be fed from the PG&E local distribution system in the Los Osos Valley, the Baywood Feed, via a repurposed (converted to 12-kV) 230-kV transmission corridor and a reconfigured Unit 2 auxiliary transformer fed from the 500-kV switchyard. Transitioning to the new system will require the same complete design review and analysis as would any new electrical installation, including load flow and fault analysis. The new system configuration will be modeled along with the existing 12-kV underground system that will tie into the new C&D load centers.

Figure 4-2: Cold and Dark Power Layout – 500kV Yard to Power Block

Once the Baywood Feed load center is in service, the Unit 2 main bank and auxiliary transformers will be cleared to install a second C&D power load center at the south end of the Turbine Building. This load center will be fed from the Unit 2 500-kV main banks via a re-configured isophase bus and 12-kV auxiliary transformer. The output bus work, from the auxiliary transformer, will be reconfigured to disconnect it from the normal plant 12-kV bus and re-connect it directly to the South C&D load center, which also will be tied into the 12-kV underground distribution system. Once the second C&D load center comes on line, the Unit 1 main bank and 500 kV transmission lines will be permanently de-energized and removed. Each of the C&D load centers will be able to carry the full 10 MVA anticipated maximum decommissioning load for the C&D system. The configuration of the load centers within the 12-kV underground distribution system (see Figure 4-3) will allow either load center to pick up the entire decommissioning electrical power requirements.

Figure 4-3: Cold and Dark Power Layout – Power Block



Once the C&D system is in place, and the SFPI system is installed and functioning, preparations will be made to de-energize the original electrical power distribution systems and equipment. The startup transformers, the Unit 1 main bank transformers, and the Unit 1 auxiliary transformers will no longer be required and will be released for decommissioning. The Unit 2 main bank transformers and one Unit 2 auxiliary transformer will remain in service to power the South C&D load center until all spent fuel is transferred to dry cask storage. After all spent fuel is in dry cask storage, and necessary security facilities are in place, the Baywood 12-kV power feed will be the sole source of off-site power. This feed will be re-configured to meet long-term power requirements for the duration that spent fuel is retained on site.

Baywood Substation Power Feed and Alternatives Considered

PG&E evaluated several options to provide long-term decommissioning power sources.

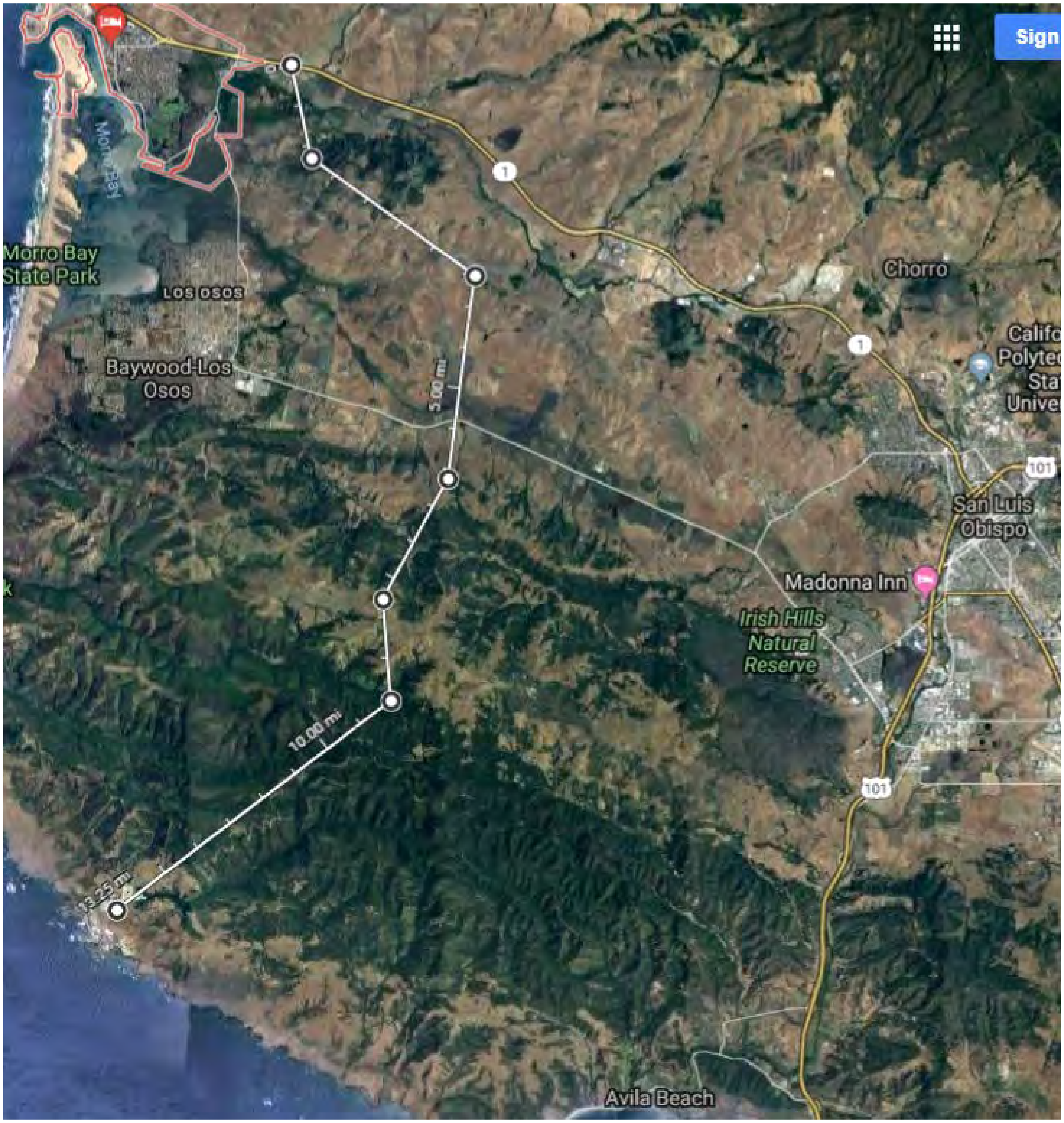
PG&E considered and dismissed continued use of the existing 230-kV transmission lines. The 230-kV switchyard is slated for removal. Current electrical transmission standards preclude establishing new transmission voltage level single source tap line, which DCPP would become once the switchyard is removed from service. A spare 230/12-kV startup transformer would be available on-site; however, it is a very large transformer, which would be inefficient to operate and costly to transport, install, and protect. In addition, even a small 230/12-kV transformer would be inefficient at the loads anticipated for decommissioning and for the anticipated long-term power needs. The cost to purchase and install a transformer, and consistently sized load center at the end of the 230-kV lines, would be significantly higher than the proposed Baywood feed.

Using the 500-kV transmission lines to power the site is impractical. The load would be diminutive when compared to the smallest 500/12-kV transformer configuration load capacity. Like the 230-kV option, the costs to buy and install the appropriate transformer, load centers, and electrical protection would be considerably more expensive for 500-kV rated equipment than the proposed Baywood option.

The options of bringing additional 12-kV power into the site from Los Osos and Avila Beach were eliminated due to their great cost. Either of these options would require approximately 10 miles of new distribution line. There is a lack of readily available capacity at the source ends of these lines. Another consideration is the effort associated with establishing new right of ways and managing additional permits and processing those permits through various state and local agencies. PG&E has experienced significant adverse issues associated with 12-kV overhead lines along the coast between Montana De Oro State Park and the power plant, such as arcing initiated fire starts, which would require installing any new coastal lines underground.

A more practical option, selected for a long-term power source, involves disconnecting the no longer required 230-kV transmission lines in the Los Osos Valley, north-west of the power plant, and repurposing those lines as a new 12-kV distribution line supplied from the existing PG&E Baywood substation (see Figure 4-4). This option uses existing towers and poles along existing right of ways. It also uses about 10 miles of existing transmission lines that are repowered down from 230-kV to 12-kV. It involves installing approximately six miles of new 12-kV distribution line, expected to be installed beneath an existing 70-kV line, along an existing right of way, using existing poles where practical. Work along this route is through rugged terrain with significant variations in elevation over heavy vegetation. Several poles are likely to require replacement to provide the required separation from ground and the different voltages. Much of the work will require helicopter support.

Figure 4-4: 12-kV Baywood Power Feed



Significant work must be completed to upgrade distribution capacity regardless of where the new power source comes from. To connect power from the Baywood Substation, a new 12/12-kV regulating transformer and load center will be installed in the 500-kV switchyard. The substation must be upgraded, including the installation of a new (70/12-kV) transformer, bus work, circuit protection, and various supporting structures, to absorb the added load. A new 12-kV distribution power line must be routed along an existing right of way to its intersection with the current 230-kV transmission lines. Some new poles will be required, and some of the existing transmission towers must be modified to accommodate the physical load changes resulting from the new configuration of the transmission lines and the new 12-kV Baywood power feed. In addition, work must be performed at the plant site to re-route and tie the former 230-kV lines to a new dead-end structure and drop to the new 12-kV regulating transformer in the existing 500-kV switchyard.

PG&E has identified specific plant equipment that must be re-powered from the C&D system for safety, habitability, and decommissioning. This includes, but is not limited to, fire suppression systems, radiation monitors, cranes, ventilation fans, etc. A team of electricians will be required to support a continuum of power requests. That team will repower the selected essential equipment using flexible cables extending from the C&D load centers. They also will make connections to existing lighting and temporary lighting to support work once the plant is taken to Cold and Dark.

C&D Power Project Cost

C&D Power material and equipment costs include all associated major components, such as transformers, load centers, pad mounted equipment, and cable runs both under and above ground. The labor costs include design and installation man-hours. The cost to install the Baywood feed is also included. The total cost for Cold & Dark Power can be found in Table 4-1 under Decommissioning Preps/Plant Modifications.

Spent Fuel Pool Island Modification

Within a few weeks after permanently shutting down each reactor, all the fuel assemblies will be transferred from the reactor vessels to the Unit 1 and Unit 2 SFPs. The SFPs are located at opposite ends of the Fuel Handling Building, which stands along the east edge of the power plant. The fuel in the SFPs will continue to generate significant decay heat for several months after being transferred from the reactor vessels. Decay heat will be addressed by cooling the SFP through a system of inter connected piping, pumps, and heat exchangers that transfer the excess heat to the ocean. The Auxiliary Saltwater (ASW) Piping systems that help cool the SFPs are routed underground from sea level at the Intake Structure up to the 85' elevation Turbine Building. Seawater circulates from the intake to the Component Cooling Water (CCW) heat exchangers, which are in the east-central area of the Turbine Building, and back to the ocean via the Discharge Structure. The Component Cooling Water piping that helps cool the SFP is routed from the Turbine Building, through the Auxiliary Building to the SFP heat exchanger in the Fuel Handling Building. All pipes associated with SFP cooling extend from the Intake Structure, at the western edge of the site, through the Turbine Building to the Fuel Handling Building at the extreme east side of the plant and back to the Discharge Structure, again at the western edge of the site. The SFP Cooling, CCW, and ASW systems along this route must all function to cool the SFPs.

The nature of decommissioning work can present challenges to preserving reliable SFP cooling using the original systems described above. It’s anticipated a significant amount of heavy vehicle traffic will be routed over the buried salt water pipes. Since the original systems are spread-out, they are also exposed to potential damage associated with excavation, other demolition, and human error. Installing smaller and more consolidated independent cooling systems for the SFPs would significantly reduce the footprint of cooling equipment and, as a result, significantly reduce risk. To abandon the existing plant systems (including ASW, CCW, and SFP Cooling) that are normally used to cool the SFPs, an alternative independent SFPI must be designed, purchased, installed, and tested. Equipment associated with this configuration will be powered from the new C&D power distribution system. Once the new SFPI equipment has been installed, tested, and certified for long-term operation, the permanent plant cooling and associated support equipment can be shut down, the systems drained, and components removed. This eliminates potential adverse impacts on SFPs cooling and personal safety due to decommissioning work in the Turbine Building, Auxiliary Building, and Intake Structure. It also eliminates the need for ASW. Security measures can be re-evaluated, and at the intake, eliminated. This allows decommissioning of the intake to proceed, unabated.

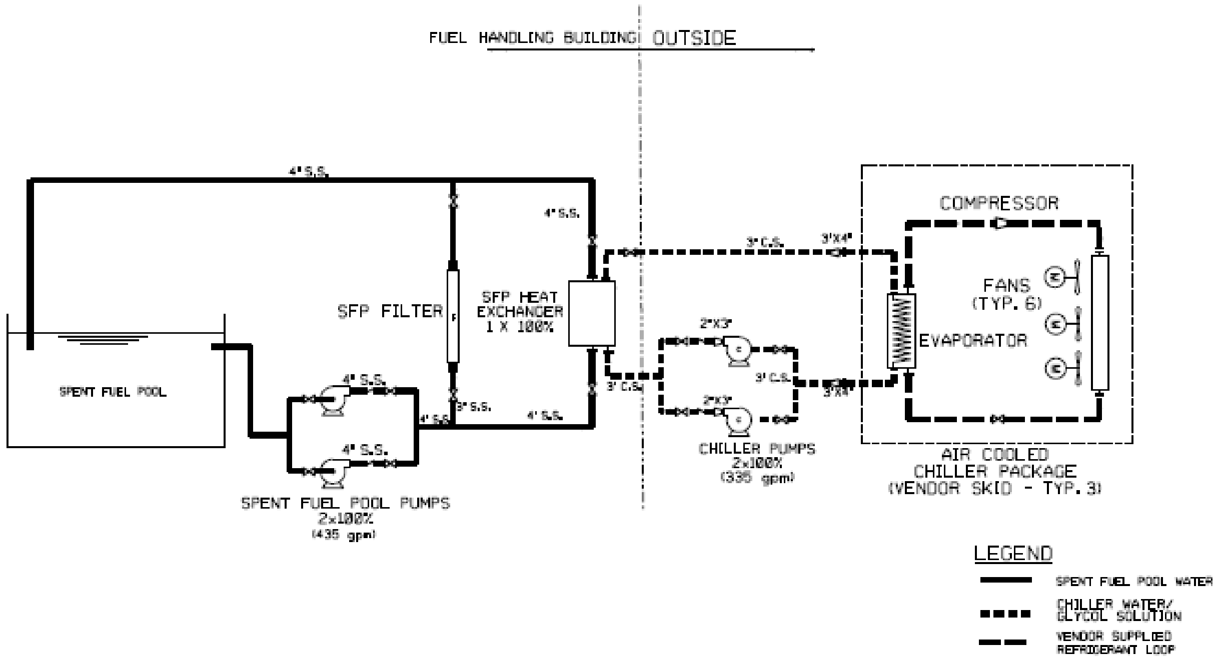
Initially the fuel moved into the SFPs will be allowed to cool for several months using the original plant systems. This will reduce the heat load on the SFPs and allow for the installation of a new, smaller, and more economically sized system. The SFPI equipment will be designed and sized for that smaller heat load. It also will allow use of a system that discharges heat to the air outside of the Fuel Handling Buildings rather than relying on the use of long pipe runs in order to use the ocean as a heat sink. The SFPI installation work, including clearing space by removing chemical injection pumps and tanks that will no longer be needed, will begin shortly after shutdown. The installation and final testing is expected to be complete to support SFPI operation approximately 18 months after shutdown, consistent with the end of the zirconium fire window. Once all the spent fuel is transferred to dry cask storage, the SFPI systems will be shut down and slated for decommissioning.

PG&E considered using the original SFP cooling system for the entire wet storage period, from final core offload to moving all spent fuel to dry cask storage. This option was dismissed for several reasons. The risks associated with keeping the existing equipment operational during decommissioning, along with higher maintenance and operations costs associated with the equipment, were the primary deterrents.

Several SFPI options were considered, and five of the most promising options were evaluated in detail. Those options were considered viable based on benchmarking that identified their use in other decommissioning facilities or in other common industrial applications. Both single and two-loop direct radiator-type systems were dismissed because the costs of procurement and installation were high, and the footprint required to install the coolers was large. A two-loop wet cooling tower option and multiple loop refrigerated cooling options were evaluated as the most feasible options. Ultimately the team selected the use of a three-loop chilled water approach as the best balance of cost, reliability, flexibility, and limited risk.

The selected design (see Figure 4-5) keeps potentially contaminated SFP water within the Fuel Handling and Auxiliary buildings. The SFP heat will be exhausted from chillers located on the west side (outside) of the Fuel Handling Building at an elevation of 140'. Considerations for siting the new SFPI equipment ensure that the new equipment won't inhibit spent fuel transport to the ISFSI, affect crane movement, interfere with security, or block any planned transportation path.

Figure 4-5: Spent Fuel Pool Island Cooling System



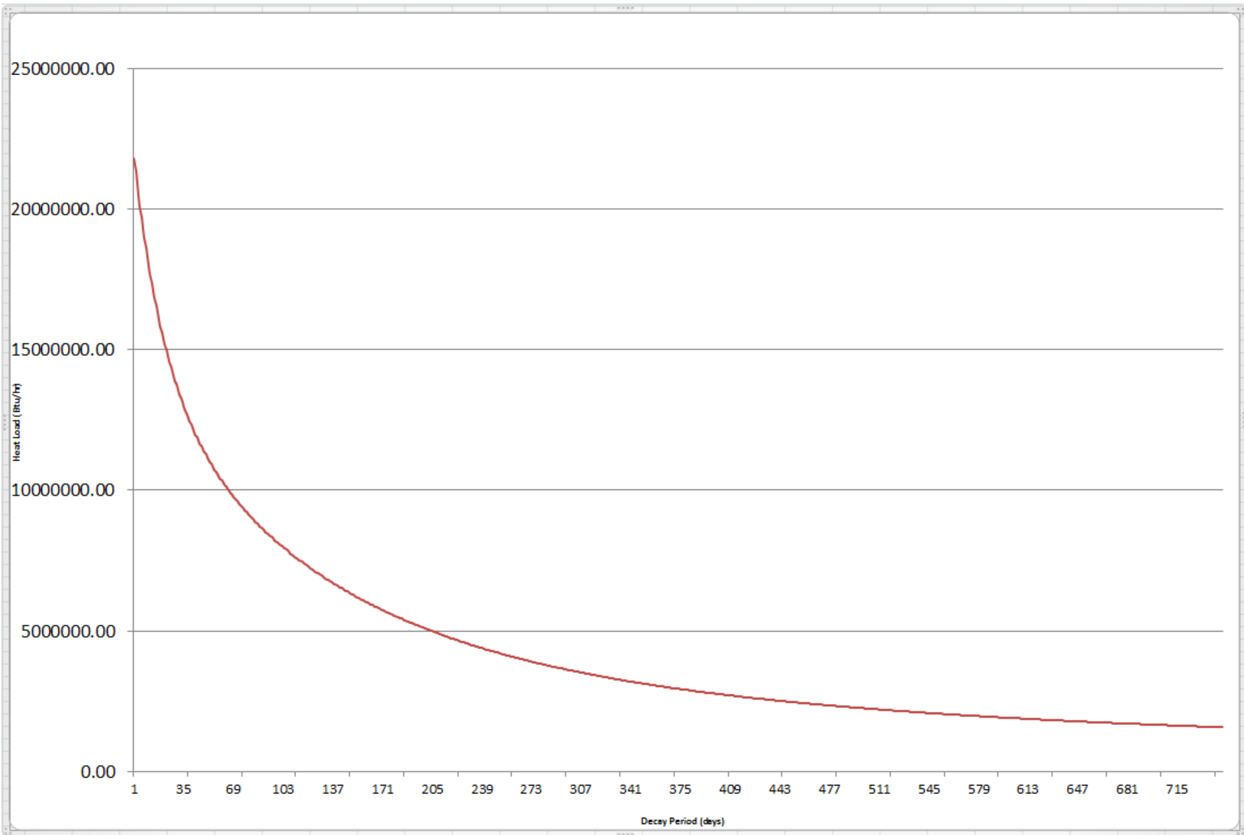
PG&E conducted area inspections to ensure that the new equipment will be installed in locations that minimize costs and other impacts on decommissioning. The inspections identified that chemical injection pump and tank equipment will need to be removed early to install new equipment.

The selected system will cool and filter the SFP water. It meets design requirements as established for a new SFP cooling system. All components and piping that carry or will be in contact with SFP water will be completely contained within the Fuel Handling Building. System design limits the risk associated with leakage of potentially radioactively contaminated SFP fluid to uncontaminated process fluids or areas. The design provides a source of makeup water and the ability to collect SFP cooling system leakage and fluid drains that allow for efficient transport to liquid radioactive water processing facilities.

A new source of compressed gas, required to maintain the pneumatic seal for the gate between the SFPs and the fuel transfer canal, is also part of the SFPI design.

A new engineering basis must be developed for the design of a new independent cooling system. Then, the system must be designed to meet the requirements of the new basis. Finally, the new system must be installed without disrupting the original cooling system, and it must be tested to verify that it meets requirements. Only then can the original system be permanently secured and abandoned for decommissioning. Developing a new basis requires new analysis to support the development of the long-term SFP heat load curve (see Figure 4-6). This curve plots total SFP heat load from final core offload through the next 10 years. This will be an essential element in optimizing SFPI equipment sizing and establishing the best time to deploy the new system. The heat transfer capacity of the system will be determined using this curve. Industry operating experience has been gathered and reviewed to take advantage of the experience of other decommissioning nuclear facilities.

Figure 4-6: Spent Fuel Decay Heat Rate Curve



Project Plan

Deploying the SFPI is a complex process. Section 4.1.1.1.1 addresses the need for considerable pre-planning, including design development, licensing, permitting, work planning, and procurement of equipment and materials. Much of this work must begin long before the planned shutdown of the units. The planning process will begin with detailed design development in January 2023. The final Unit 1 design will be completed at the end of 2023. Procurement planning for long lead time equipment begins concurrent with the design change development and will be completed prior to each Unit shutdown. Purchase orders will be issued as needed for long lead time equipment to support the installation schedule prior to Unit 1 shutdown.

Installation activities, including early demolition of existing plant equipment to make space for the new system, will begin shortly after each unit shuts down permanently. The Unit 1 installation will be completed near the beginning of 2026, with Unit 2 following near the end of 2026.

System and Area Closure Support to SFPI

The System and Area Closure Plan 02 describes how plant equipment will be accessed and removed early enough so that SFPI components can be installed in exisiting building locations. This work is a prioritized subset of area dismantling/disassembly work scope, which will be performed earlier in the decommissioning project to support the Power Block Modifications related to the SFPI and/or Cold and Dark scopes, by physically removing systems and components.

The SFPI installation will require open floor space near the SFPs at certain elevations to allow for installation of the SFPI components and controls. The areas will be accessible to operators and provide physical height differences to the SFPs to ensure that design assumptions remain valid.

Two different rooms near each SFP will be used for the SFPI. The first room currently contains Chemical Injection Pumps and tanks. Once this equipment has been removed, there will be sufficient space for efficient routing of needed piping, controls, and indication. Five Chemical Injection Pumps and motors must be removed from their equipment pedestals in each room, along with attached suction, discharge, and recirculation piping contained within the north, south, and west walls and approximately 12 ft. east from the center of each pump housing. This includes removal of the associated equipment pedestals down to the room floor elevation to allow for appropriately sized mounting locations for new SFPI equipment. This also includes complete removal of the associated chemical tanks (two per unit) along the west wall and the measuring tank (one per unit) along the north (Unit 1) and south (Unit 2) room walls and attached tank piping within the room on an approximate 12-ft. radius from each of these tank centers.

The second room near each SFP is located within the RCA outside on the 140’ elevation immediately next to the Containment and The Fuel Handling Buildings. This outside area (one for each unit), once cleared of currently installed equipment, will provide sufficient space for efficient routing of needed piping, controls, and indication. In order to use this room, the SG Blowdown Tank No. 1 (one per unit) must be removed, including the surrounding steel support structure and elevated walking platform. The blowdown and other miscellaneous piping and mechanical components attached to the blowdown tank within the footprint of the elevated walking platform or within an approximate 12’ radius from the centerline of the blowdown tank, whichever is greater, also must be removed.

Project Cost

SFPI total cost includes material, equipment, and labor for design and installation. This includes all associated major components, such as pumps, chillers, heat exchangers, filters, and valves, along with interconnecting piping and hoses including miscellaneous materials and hardware. The cost to remove currently installed equipment to facilitate SFPI installation is also included. The total cost of installing the SFPI is in Table 4-1 under Decommissioning Preps/Plant Modifications.

4.1.1.2.2. Site Infrastructure Modifications

Site Infrastructure modifications are changes to site facilities, civil features, utilities, and equipment that will be required to support general decommissioning activities. By developing a robust infrastructure suited to decommissioning needs, these modifications will help transition DCPP from an operational site to a decommissioning site and provide the framework to successfully execute the project. Lack of adequate support could lead to schedule delays and added costs. Site Infrastructure changes to support decommissioning cover many areas, including:

- Facilities (such as buildings, structures, trailers, defensive positions, sheds, and ancillary facilities)
- Civil features (such as roadways, haul routes, drainage, parking lots, storage areas, staging areas, retaining walls, pathways, walkways, stairways, fences, and gates)
- Overhead and underground utilities and systems (such as domestic water, fire water, electrical, wastewater, t-com, heating, ventilation, and cooling (HVAC) systems, fire detection and suppression systems, public address systems, site alarm systems, information technology (IT) systems, and light stanchions)
- Specialty equipment, systems, and facilities (such as truck scales, portal monitors, gamma radiation assay survey system, passive and active vehicle barriers, alarm stations, control rooms, security access buildings, and rubblizing facilities that reduce existing concrete into rubble)

Waste Handling Facilities

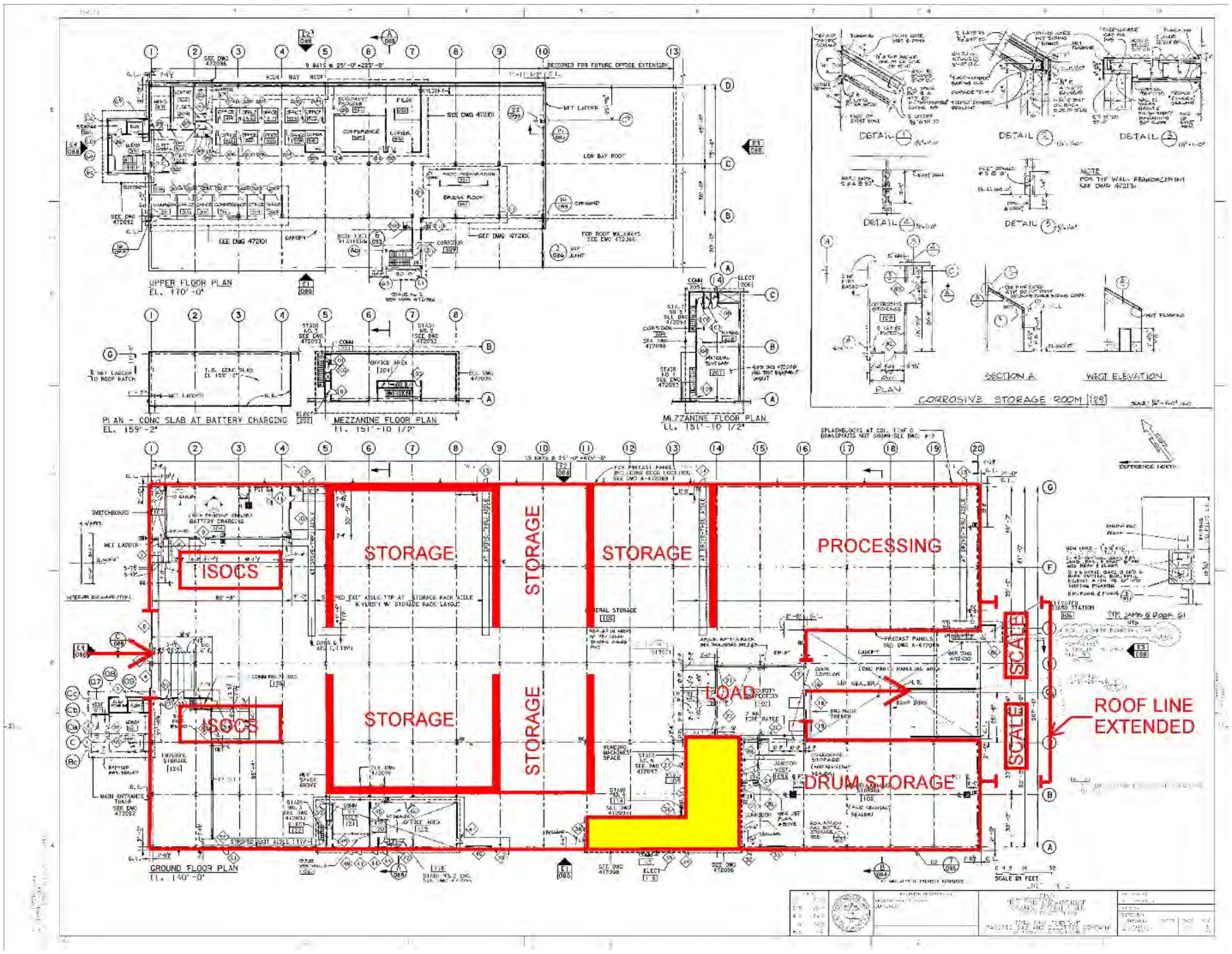
To support decommissioning efforts, existing structures will need to be modified and new structures will need to be installed to process and manage the large volumes of debris that will be generated. These activities include the transportation of waste from the point of generation (where buildings, equipment, components, and systems are being demolished or removed) to structures where it will be stock piled, sorted, segregated, sized, surveyed, and packaged before being shipped to an approved facility off-site. Heavy equipment such as trucks, loaders, and forklifts will be used in and around these facilities as part of the waste handling process.

At DCPP, the Main Warehouse (Building 115) is the most practical structure to be modified to meet industry standards for a waste handling facility because of its size and location within the main PA. This three-story, steel-framed building has a nominal footprint of 207 ft. wide by 475 ft. long (98,325 square ft.). It consists of a slab on grade with perimeter and interior footings that support structural steel members that are covered on the exterior by metal siding. It is in the southeast corner of the main PA and currently serves as the main warehouse, housing storage racks for spare parts, equipment, and tooling. It also contains office areas on the west side of the building, an environmental storage area (approximately 85 ft. long by 35 ft. wide), a battery charging room on the northeast side, a miscellaneous storage area on the southwest side, restrooms, and a loading dock.

To make room for waste handling activities, the building's interior will be cleared of storage racks, spare parts, equipment, tooling, and other commodities that will no longer be required after plant shutdown. The slab will be coated with a sealant to limit the intrusion of unwanted contaminants into the concrete, and robust barriers will be placed around the interior columns in areas where equipment will be operated to protect them from damage that could compromise the building's structural integrity.

The center of the building will be subdivided into several zones to provide designated storage areas for different types of waste / material (e.g. soil, concrete, steel, etc.) and contamination levels. The southeast portion of the building will be the waste processing area and will provide room to sort / segregate, size, and package waste material. The existing opening at the north end of the building will be enlarged and large roll-up doors will be installed to accommodate increased truck and equipment traffic. Inside the roll up doors, two In-Situ Object Counting Systems (ISOCS) will be installed to monitor the material entering the building. At the south end of the building, the loading dock will be filled in, openings will be enlarged, roll-up doors will be installed, and the roof line will be extended to house two truck scales and monitoring equipment to screen shipping containers (intermodals) exiting the building with packaged waste. Throughout the building a high-efficiency particulate air (HEPA) filtration system will be installed to mitigate dust created by waste handling and emissions from the equipment being used. Figure 4-7 below shows the floor plan of Building 115 and the modifications that will be made to convert it into the waste handling facility.

Figure 4-7: Building 115 – Waste Management Facility Floor Plan



Existing offices on the west side of the building will be modified to support waste handling personnel. They will be sealed and insulated from the waste handling areas, and new HVAC systems will be installed to create a separate "building envelope" to mitigate dust, emissions, noise, and vibrations generated by waste handling activities.

A review of decommissioning activities at Connecticut Yankee and Maine Yankee nuclear power plants found that waste handling and associated facilities can take up a large footprint. Likewise, to support decommissioning at Zion Nuclear Generating Station, two large tent-like structures were built as waste management facilities. These structures consisted of a slab on grade with metal framework covered in impermeable fabric; they were 100 ft. wide, 200 ft. long, and 55 ft. tall. At HBPP, four waste management facilities were built. One was 40 ft. wide by 80 ft. long and used to receive intermodals, repair intermodals, and package LLRW. Two were 100 ft. wide by 200 ft. long with openings at both ends that measured 20 ft. high by 48 ft. wide; one of these was used to package and ship low-level contaminated soils, while the other was used to package and ship non-radioactive soils. The fourth facility was a metal structure measuring 100 ft. wide by 125 ft. long with one large opening; it was used to store, repair, and prepare radioactive waste shipping containers.

Other facilities in addition to Building 115 will be needed to store, sort, process, and package waste. These facilities will be similar to the tent-like structures that were used for decommissioning at Zion and HBPP and will mitigate potential contamination issues. Five of these structures will be placed in different areas (Lot 1, Lot 7, Lot 8, adjacent Building 403, and on the Building 104 slab) to support staging areas (further described in the staging section below). Each structure will be 100 ft. long by 100 ft. wide and provide shelter for workers, equipment, and material being processed.

An additional lesson learned from PG&E's review of decommissioning activities at Connecticut Yankee and Maine Yankee was to plan for the eventual relocation and elimination of the waste handling, packaging, and shipping areas. By coordinating the placement of these facilities with the needs and schedules of the various scopes of work, and by considering up front the need to relocate and eliminate these facilities, DCPP will optimize waste handling facility locations and use as well as their eventual elimination.

Building Modifications

Site conditions and staffing levels will change throughout the different stages of decommissioning. Buildings and ancillary facilities inside the Main Power Block PA and around the power block will be demolished early to provide haul paths, lay down areas, equipment storage, and staging areas to accommodate planned decommissioning activities. As these buildings (and other buildings on-site) are removed, staff will be displaced and will need to be relocated to facilities that contain office space, conference rooms, restrooms, and break areas. These facilities should be located outside of the Main Power Block PA to eliminate non-essential personnel from processing through the security search train and should be located away from demolition, equipment movement, and haul routes for personnel safety. A cost-effective way to do this is to repurpose existing facilities, which will reduce the number of new facilities that need to be built or temporary accommodations that need to be provided (see Section 4.1.1.9.14.2).

Several facilities at DCPP meet the parameters outlined above and will be repurposed to house displaced staff. One of these is Building 109, a two-story, steel-framed building with a nominal 99 ft. by 195 ft. footprint that currently serves as the Simulator Training Building and is located outside of the PAs west of parking Lot 4A. The ground floor contains the Control Room Simulator in the center, with support rooms surrounding it; six classrooms, each seating approximately 25, on the perimeter of the north and south ends; a kitchenette and dining area on the west perimeter flanked on either side by six offices (three to the south and three to the north). The second floor contains four classrooms and office space. Men's and women's restrooms are on both floors. One elevator is in the northeast corner, and two flights of stairs are on opposing corners of the building (one in the southwest, the other in the northeast).

Another facility is Building 119, a two-story, steel-framed building with a nominal 92 ft. by 216 ft. footprint that currently serves as the Maintenance Shop Building. The ground floor contains the dosimetry office, the document library, maintenance training and shop spaces, and men's and women's locker rooms with showers. The second floor contains several shop / lab spaces for various work disciplines in the center, office spaces on the north and south perimeter, as well as men's and women's restrooms. The northwest side is connected via a covered breezeway to the south side of Building 109.

Both buildings will be repurposed into administration buildings to support decommissioning staff. The interior spaces will be cleared of simulator equipment, shop equipment, tooling, and other commodities that will not be required after shutdown. This will create open spaces and provide additional room that will be subdivided into office spaces, conference rooms, and break areas. These upgrades are tenant improvement in nature and will provide adequate space to house the on-site employees and include office equipment such as desks, chairs, computers, and TCOM / IT equipment. The building modifications will comply with applicable fire codes for the number of personnel; have adequate evacuation routes in case of emergency; have adequate access to emergency service such as fire and ambulance; contain lighting, heating, and air conditioning; comply with American with Disabilities Act (ADA) guidelines; and be securable to prevent unauthorized access during working and off-hours. Figure 4-8 though Figure 4-11 below shows the floorplans and modifications for Buildings 109 and 119.

Figure 4-8: Building 119 – 1st Story Floor Plan

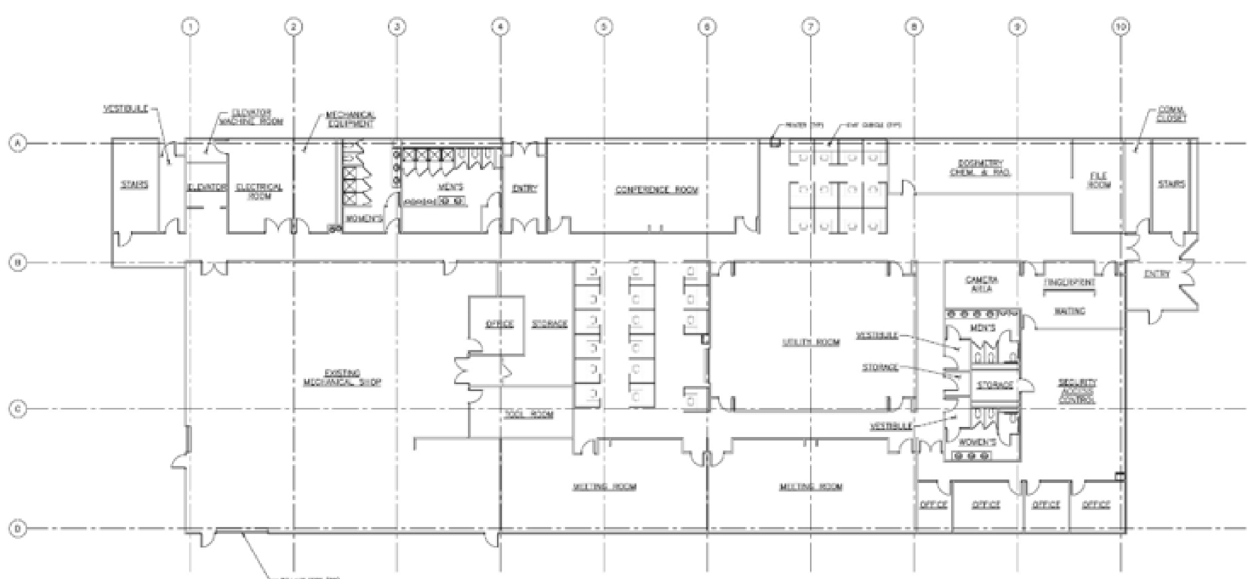


Figure 4-9: Building 119 – 2nd Story Floor Plan

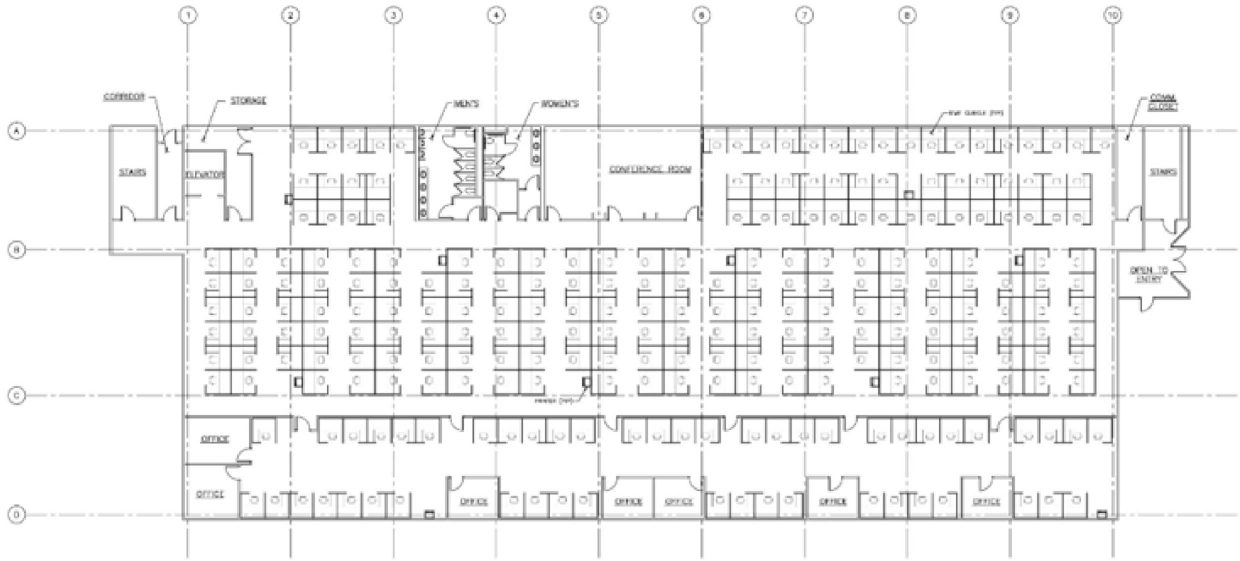


Figure 4-10: Building 109 – 1st Story Floor Plan

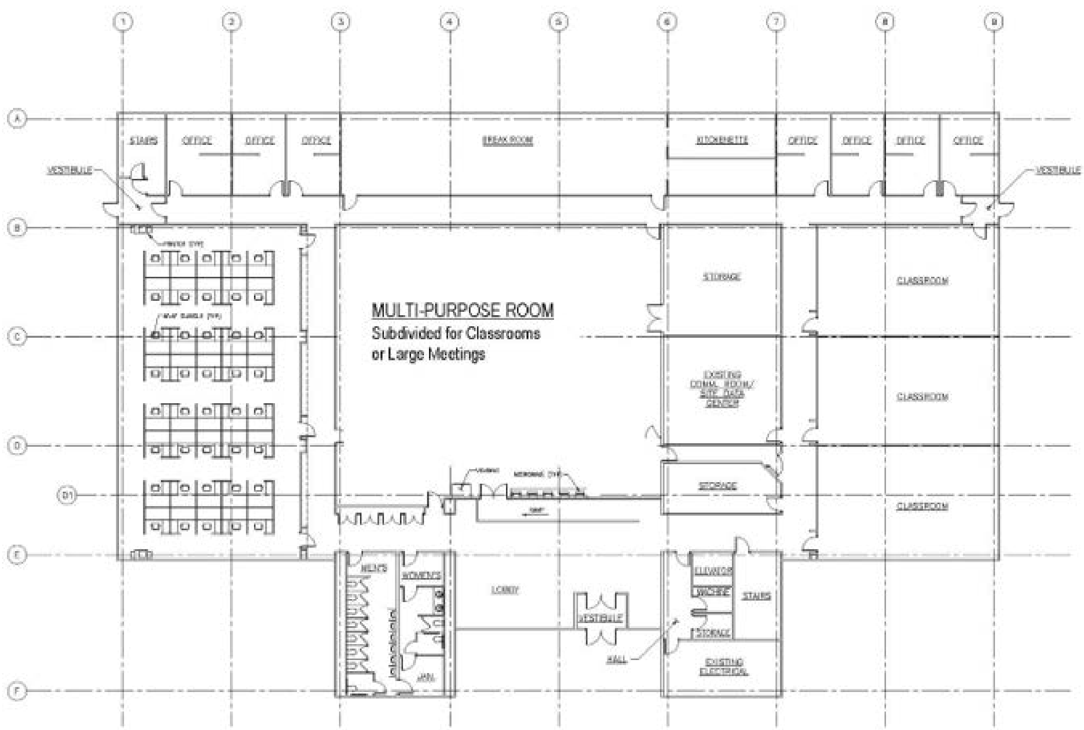


Figure 4-11: Building 109 – 2nd Story Floor Plan

Environmental Count Room / Lab

Radiological and environmental sampling will be performed throughout decommissioning through Final Site Restoration, and it will require support from an on-site laboratory because all radioactive materials must be surveyed and characterized prior to waste disposal.

DCPP currently has two laboratories / count rooms. The primary (hot) lab is adjacent to the primary RCA access control point at the 85' of the Auxiliary Building along with the RP count room and the chemistry radiological count room. The secondary (clean) lab is on the second floor of the Unit 2 Turbine Building buttress. During demolition of the Auxiliary and Turbine Buildings, these labs will be eliminated, and a new count room will be needed.

Key stakeholders and SMEs from HBPP and DCPP provided the following list of recommended attributes:

- Facility should be sited so that it doesn't interfere with decommissioning activities
- Facility location must maintain a low and predictable background radiation level
- Facility must be capable of operations around the clock (24 hours a day / 7 days a week)

- Facility must be capable of processing environmental samples for both radiological and NPDES permit requirements
- Facility must be easily and quickly accessible for transporting radiation protection samples, air filters, lapels, etc., in a timely manner
- Facility must have dependable and stable power supply for equipment
- Facility must have dependable and stable ventilation
- Facility must have adequate space to house equipment needed for anticipated throughput
- Facility location must be accessible for regular deliveries of liquid nitrogen (for gamma spec analyses) and P-10 gas (for alpha / beta analysis)
- Facility must have adequate space for storage of consumable materials, including beakers, sample bottles, sample tools, etc.
- Facility must contain a segregated radioactive liquid waste collection system
- Facility must provide room for packaging and shipping preparation
- Facility must have area for solid waste disposal

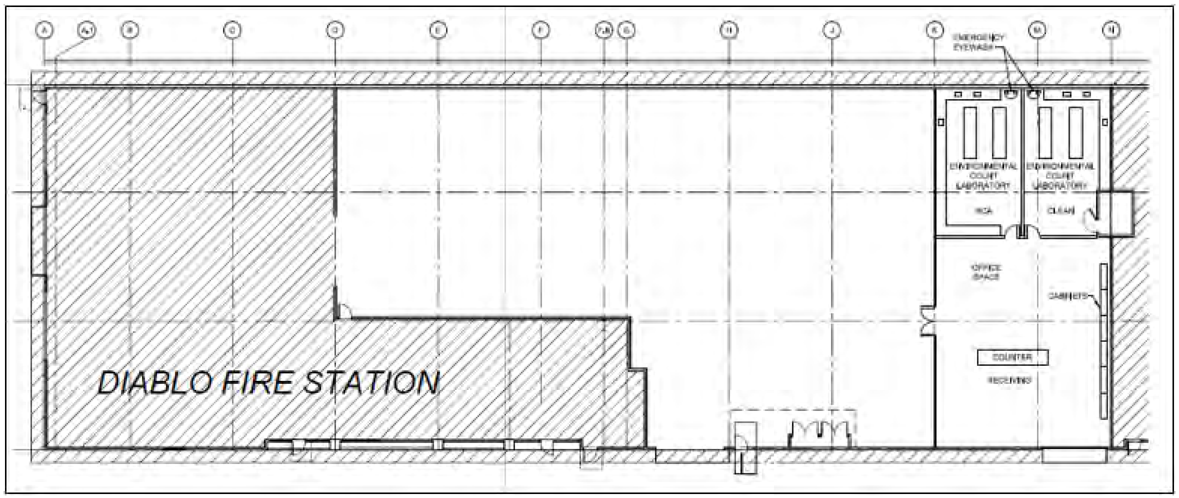
Three suitable options were identified:

1.) Relocating a count room to the Main Warehouse (Building 115) in the southeast corner of the PA
2.) Relocating the facility to the FLEX Storage Building (Building 113) located east of Lot 1
3.) Constructing a new facility elsewhere on-site

After reviewing the requirements and comparing the options, PG&E decided to reconfigure Building 113 as the new environmental count room/lab. Building 113 is a metal-framed building with a nominal 85’ by 350’ footprint located west of Lot 1 where the access road terminates at the site. The north end of the building is two stories and houses the fire department, with living quarters on the second floor and offices and an apparatus bay on the first floor. The remainder of the building is single story and houses access and badging offices to the south end along with the fitness for duty department. The center section of the building serves as storage space for FLEX equipment that is required as part of DCPP's "Flexible and Diverse Coping Strategy." After shutdown and once the used fuel has sufficiently cooled, the FLEX equipment will no longer be required, and the center portion of the building can be repurposed to serve as the count room and laboratory for environmental analysis.

Figure 4-12 below shows the floor plan of Building 113 and the modifications that will be made to convert a section of it into the environmental count room.

Figure 4-12: Building 113 – Environmental Count Room Floor Plan



Modifications will include the addition of electrical, domestic water, and sanitary utilities to support lab equipment, as well as office space and TCOM equipment for personnel. A majority of the lab equipment needed is already on-site but will need to be relocated and, in some cases, modified. Equipment needed to perform water system analyses include pH meters, conductivity meters, microwave digesters, refrigerators, glassware, filtration equipment, vacuum pumps, thermometers, titration equipment, pipettes, and inductively coupled plasma spectrometer for metals analysis.

The existing chemistry count room has four high purity germanium (HPGe) detectors with associated multichannel analyzers (MCAs) using Apex software for counting various radiological samples in predetermined geometries. In addition, there are two Tennelec detectors used for chemistry purposes, which will be converted to support RP alpha / beta smear and air sample counting instruments, and two new liquid scintillation counters for tritium and other beta emitters. The RP count room also has useful equipment, such as an 85 percent efficient HPGe detector with a LabSOCS calibrated MCA using Apex software, a Tennelec for smear and air sample counting, and up to 10 available Ludlum 3030 alpha / beta scalers.

PG&E will save DCPP decommissioning costs and avoid generating additional waste by upgrading an existing building and relocating existing equipment. In addition, using existing equipment should streamline lab processes and mitigate errors because site personnel are already familiar with their use.

ISFSI / GTCC Security Building

Currently, DCPP has three separate PAs -- the main power block, Intake Structure, and ISFSI. After DCPP Units 1 and 2 are shut down and all used fuel and GTCC waste have been transferred to the ISFSI, only the ISFSI PA will be necessary.

Regulatory guidelines 10 CFR 73.55 (for DCPP Units 1 and 2) and 10 CFR 73.51 (for ISFSI) require at least two continuously monitored alarm stations, with the primary alarm station located inside the main power block PA. The central alarm station (CAS) and secondary alarm station (SAS) serve Units 1 and 2 and the ISFSI and satisfy these requirements.

The CAS is currently located on the east side of the 140' deck of the Turbine Building, and the SAS is housed in the northwest corner of Building 105. Building 105 is in the southwest corner of the main PA adjacent to Gate 1 and serves as the security administrative building. After spent fuel and GTCC waste have been transferred to the ISFSI, the requirements of 10 CFR 73.55 will no longer apply to the main power block. As a result, the CAS and SAS will be relocated to a newly constructed building within the ISFSI PA to ensure that their operation is not adversely impacted by Units 1 and 2 decommissioning activities -- guaranteeing continued compliance with 10 CFR 73.51.

Benchmarking at Zion and Crystal River-3 confirmed that other plants have or plan to relocate the CAS and SAS to a newly constructed security building within the ISFSI PA. The newly constructed security building at these sites contains the CAS, SAS, and security back-up power needs (diesel) and houses all ISFSI support staff and necessary equipment/tooling.

Based on the benchmarking at Zion and Crystal River and stakeholder input from HBPP security, the new DC ISFSI security facility will:

- Be rectangular in shape
- Be contiguous with the ISFSI PA
- Be a blast- and bullet-resistant enclosure for alarm stations
- Contain a security search train with metal detectors, x-ray machines, and nitrate detectors
- Contain CAS and SAS
- Contain intrusion and detection equipment
- Contain space for the RP team and an instrument calibration area
- Contain a meeting room, break room/locker area, armory, small kitchen, restroom, small room for IT items storage, vault type SGI room (with Plotter / Scanner), Electrical Room with Uninterruptable Power Source (UPS)
- Contain a Records Management Storage Room
- Have access to biometrics on PA access
- Allow all features and equipment to be monitored and operated from CAS (e.g., fire panels, gates, remote activations, exterior gate activation, etc.)
- Have a diesel generator with an automatic transfer switch to serve as an UPS

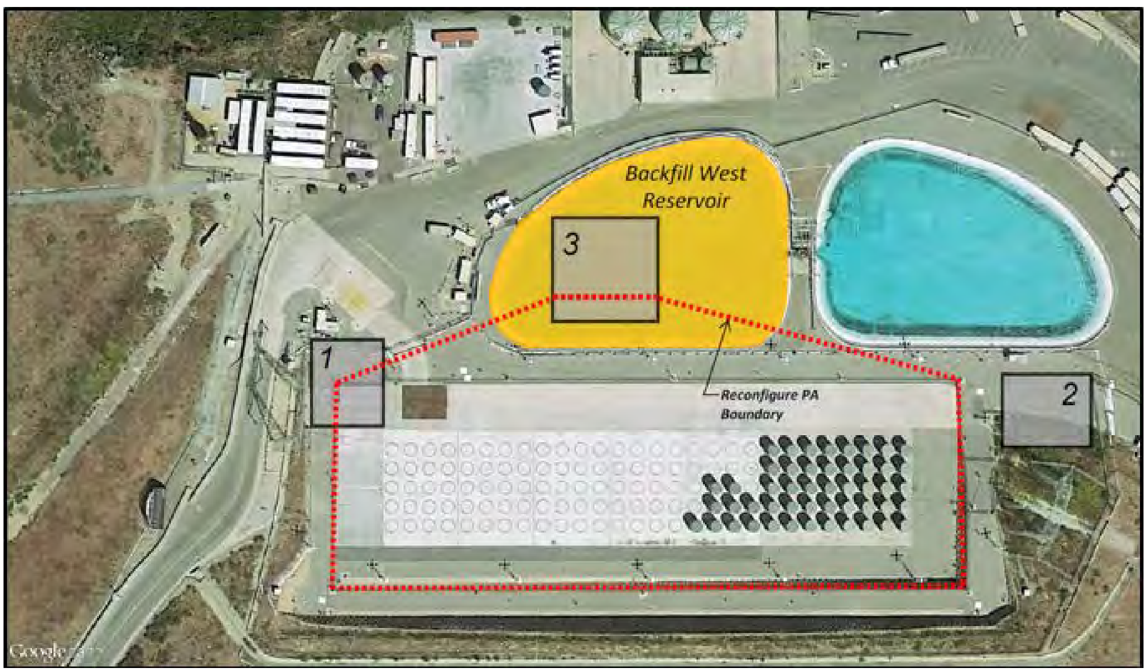
- Be oriented so that the ISFSI crawler and other equipment have adequate room to access the ISFSI PA

Three potential building sites were reviewed with a vendor involved in specifying and designing the new security building at SONGS. These sites were:

1.) Northwest: ISFSI access trailer located in the northwest corner of the ISFSI PA
2.) East: ISFSI east transmission tower, directly north of the transmission tower
3.) Reservoir: north of ISFSI, within the footprint of the west reservoir

Considerations for each building location included site topography, underground commodities, security compensatory measures during construction, impacts to security planning, and civil features (such as hill slopes, utility tie-ins, storm drainage, and transmission tower footings). Figure 4-13 below shows the three locations that were analyzed.

Figure 4-13: Options for Location of ISFSI Security Buildings



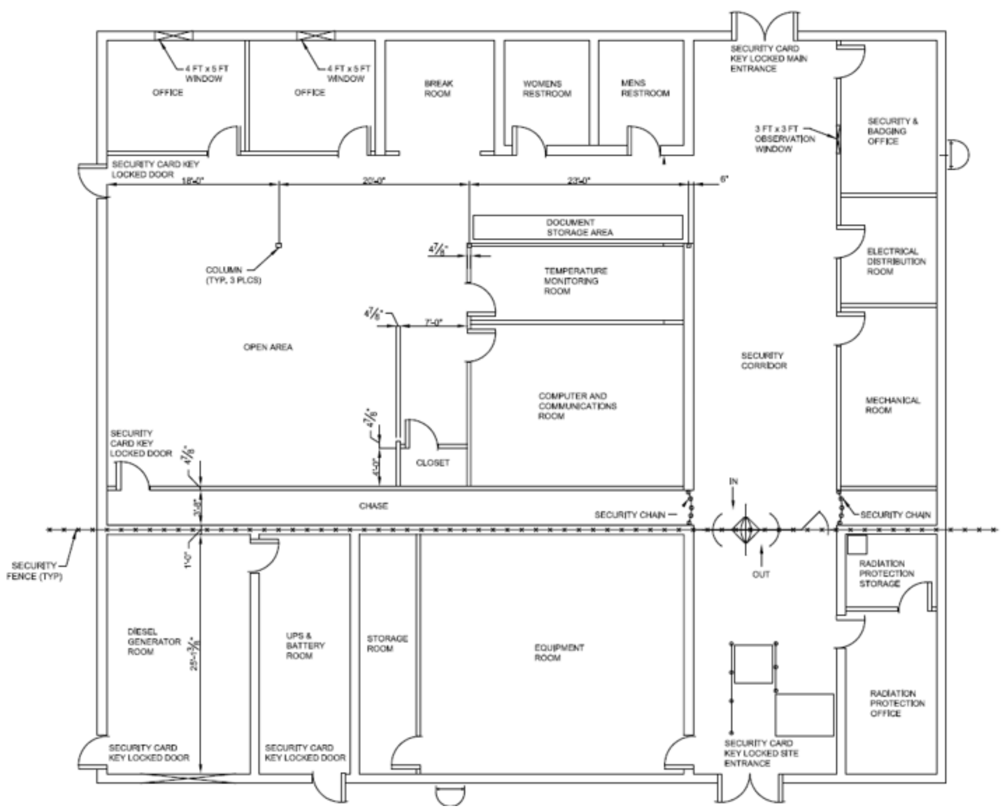
The northwest site (Option 1) is near the transmission tower footings and the edge of the slope leading to the reservoir road. Design of a large retaining wall at the corner of the new building would be required and underground utilities would have to be relocated.

The east site (Option 2) must avoid or relocate the 12-kV electrical line and other underground utility lines supporting the two reservoirs. Both the northwest and East sites also would require a reduced site footprint and a two-story structure, which presents other inefficiencies such as duplicate stairways. The Reservoir site location 3 is recommended for the ISFSI Security Building.

The reservoir (Option 3) location is outside the boundary of the ISFSI's PA, and construction will not adversely impact the security plan or require significant security compensatory measures. The reservoir location is further away from the dry storage casks, which reduces the potential for radiation exposure for building workers and future building users. Furthermore, the shutdown of the Unit 2 reactor and start of the decommissioning life cycle will significantly reduce reservoir water storage requirements for the plant. Backfilling the west reservoir will leave 2.5 million gallons of fresh water capacity in the east reservoir. The plant can operate reliably operation with one reservoir while maintenance is being performed on the other. During decommissioning, after both units are shut down, water will not be needed for cooling steam production processes, so water in the reservoirs can be dedicated for maintaining inventory in the SFPs and fire protection services. Furthermore, backfilling the west reservoir occurs after the zirconium fire window. The reservoirs also serve as a backup to other water tanks that serve as the primary makeup water to maintain water inventory in the SFPs.

Based on the information above, it's recommendation that a 6,000sq/ft building be sited on top of the filled-in west reservoir. Construction of this building will be coordinated with the planned ISFSI pad expansion (as discussed in Section 4.1.1.5) and closely coordinated with ISFSI loading campaigns to avoid schedule conflicts. A preliminary floor plan for a one-story Security Building of approximately 6,000 square ft. is shown in Figure 4-14 below.

Figure 4-14: ISFSI Security Building Preliminary Floor Plan



Access Road Maintenance

Providing site access for the safe entry and exit of equipment, material, waste, and personnel is integral to decommissioning efforts. DCPP is an isolated site, only accessible from two roads. The primary entry and exit is via the southern access road, a paved, seven-mile two lane road that goes from Port San Luis to the plant site. This road will have heavy traffic during decommissioning from trucks and other specialty equipment carrying construction debris, waste, and large components. This access road must be maintained to support this type of equipment and traffic. Maintenance activities include chip sealing, crack sealing, asphalt patching, asphalt overlays, and grinding efforts followed by replacement asphalt inlays. In sections where degradation is severe, asphalt will be removed, existing road base will be rehabbed (excavated, backfilled, and compacted), and the section will be repaved. Routine preventative maintenance will be required throughout decommissioning to keep the road in good condition and minimize conditions requiring major repairs that would impede traffic flow and waste shipments, causing potential project delays.

The northern access road is four miles long and consists mostly of a hard-packed, permeable surface, with some of the steeper areas paved. The road extends from Montana De Oro State Park to the plant site and it isn't used for day-to-day plant operations. No modifications are planned for this road as part of decommissioning. However, it will remain an alternate route for site vehicular traffic if the south access road is out of service (e.g., a landslide or extended repairs). The north access road will require periodic maintenance, mostly for weather-related reasons, depending upon its level of use.

At Zion and SONGS, rail spurs were built on-site and used for material and waste shipments. This helped alleviate traffic on adjacent public and private roadways, and reduced the wear and tear caused by the increased usage (with heavy loads). Due to geographic constraints and the isolated nature of the DCPP site, this option isn't viable. Thus, the access roads must be maintained to mitigate costly repairs and associated delays.

Site Road Maintenance and Improvements

During decommissioning, site roads are needed to interconnect staging areas, demolition areas, and support facilities. These roads will be used by trucks, loaders, cranes, forklifts, and other specialty equipment hauling construction debris, waste, and large components. Existing areas will require maintenance and repairs (comparable to those identified for the access road above) and new haul routes will be built to provide access to various areas in and around the power block.

Heavy haul traffic from Units 1 and 2 to the ISFSI will cause significant damage, particularly at curves; therefore, a concrete overlay of 1,800 ft. will be applied on the entire roadway from Gate # 20, down Shore Cliff Road, and through the curve to the parking Lot 8 entrance. In addition, when using the ISFSI transporter, steel plates should be placed at concrete joints to mitigate road damage. An asphalt base will be maintained up the road from parking lot 8 towards the ISFSI, and beyond the concrete overlay at the ISFSI gate. Roadway repairs are also planned after the spent fuel and GTCC waste storage casks are transferred to the ISFSI. The reservoir road will be used to move the old SGs and other large components from the Old SG Storage Facility (OSGSF / Building 403) east of the ISFSI. Its length is 3,400 ft. from the turn at Shore Cliff Road to the ISFSI pad.

Sections of road on the north and south sides of the Main Warehouse (Building 115) will be reconfigured to eliminate tight corners and widened to allow for increased traffic from areas around the power block, to the north side of the waste handling facility (as described in the waste handling facilities section above). The south end of the road will be graded to create a haul route to the staging area in Lot 8 (as described in the staging section below). These modifications also will require the construction of new retaining walls to account for the topography, re-routing of personnel walkways, and fence re-alignment to comply with security regulations.

Site roads, like the access road, will require preventative maintenance throughout decommissioning to keep them in good condition and prevent costly major repairs.

Staging Areas

Staging areas will be needed throughout the site to accommodate waste management, material handling, and movement and storage of large components (such as ISFSI casks and SGs) and associated equipment (such as the ISFSI crawler, cranes, and special purpose multi-wheel transporter [SPMTs]). These areas will provide adequate staging and packaging areas that mitigate contamination and exposure risks and provide obstruction-free pathways for forklifts, trucks, and other equipment to move material. In addition, the staging areas must account for moving in and out equipment, personnel, materials, and waste; and include transitions and tie-ins to adjacent site roads and haul paths aprons to adjacent infrastructure (such as site roads, buildings, walkways, parking lots, and underground and overhead utilities).

Existing parking Lots 1, 7, and 8, the foundation slab of the Administration Building (Building 104), and the area next to the OSGSF (Building 403) are ideal for staging purposes. The Main Warehouse (Building 115) will be repurposed as a central processing area for radwaste materials (as described in the waste handling facilities section above). Parking Lot 8, which is directly south of the Main Warehouse, will be used as a staging area for the intermodals used for shipping the processed radwaste materials from the south end of the Main Warehouse to off-site destinations. Parking Lot 1 will become a backup shipment staging area for both radwaste intermodal trucks and clean trucks ready to leave the site. Parking Lot 1 will have the capability to verify that the final weights of waste shipments are within DOT limits for over the road conveyance and to monitor trucks returning to the site. The foundation slab for Building 104 will not be removed after the building is demolished. The slab will be repurposed to support the Alternate RCA Access Facility in the northeast corner and a staging area in the western area. The staging area next to Building 403 will be used to segment, package, and prepare SGs and other large components for off-site shipment by the large component removal group as discussed in Section 4.1.1.6.

Parking Lot 7 will be repurposed as a central processing area for all clean, non-detect waste materials and also will house a rubblizer to crush and process concrete for reuse on-site.

A significant amount of the waste generated during decommissioning will be concrete rubble. Contaminated concrete must be sent off-site for disposal at an approved facility, but non-contaminated concrete can be processed for potential reuse onsite. At DCPP, portions of the concrete foundations and floor slabs from the Turbine Building, Medical Facility, Administration Building, Warehouse A, and concrete structures outside the RCA are candidates for rubblizing and reuse.

During decommissioning at HBPP, processed recycled concrete that was tested in accordance with the Interim Measures Remedial Action Work Plan (IM/RAW) was reused on-site in backfill applications where similar material (e.g., Class 2 aggregate) would be used. Typical locations for reuse included areas where the surface was to be paved with asphalt or concrete, minimizing surface water infiltration through the recycled concrete layer. Processed recycled concrete also was used as fill material in certain portions of the backfill of the caisson excavation.

At DCPP clean concrete rubble produced by demolition will be processed on-site to remove reinforcing steel and miscellaneous embedments before being crushed and screened to produce the properly sized concrete aggregate for its intended use. This aggregate will be stockpiled and available for reuse on-site for numerous applications (such as backfill, road base, etc.). For final site restoration purposes, this aggregate will be blended with excavated soil that has been cleared for reuse at a 5:1 ratio (soil to concrete) to create a fill that meets the requirements for on-site reuse as discussed in Section 3.3. By re-using material on-site, decommissioning will reduce costs for packaging, shipping, and disposal fees off-site. In addition, less material will be purchased and shipped for use on-site. Reuse also reduces emissions and road degradation by reducing truck shipments.

Parking Lots 5, 6, and the south end of 1 will be used as overflow lots for clean waste materials, particularly crushed concrete, if stockpiling in parking Lot 7 is at a maximum level. Concrete slabs will replace the existing asphalt surface in each repurposed parking lot (not the overflow lots) to improve durability for heavy forklift activity. Fabric tents will be installed above the concrete slab to provide an enclosed work area. Figure 4-15 and Figure 4-16 below show the proposed modifications at Lot 7 and Lot 8.

Figure 4-15: Parking Lot 7 Clean Waste Staging Area

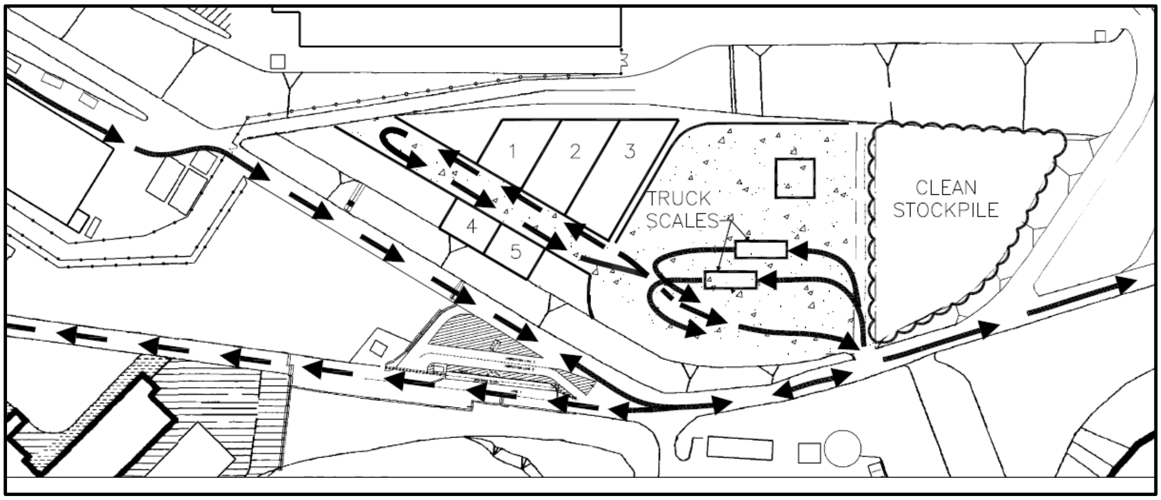
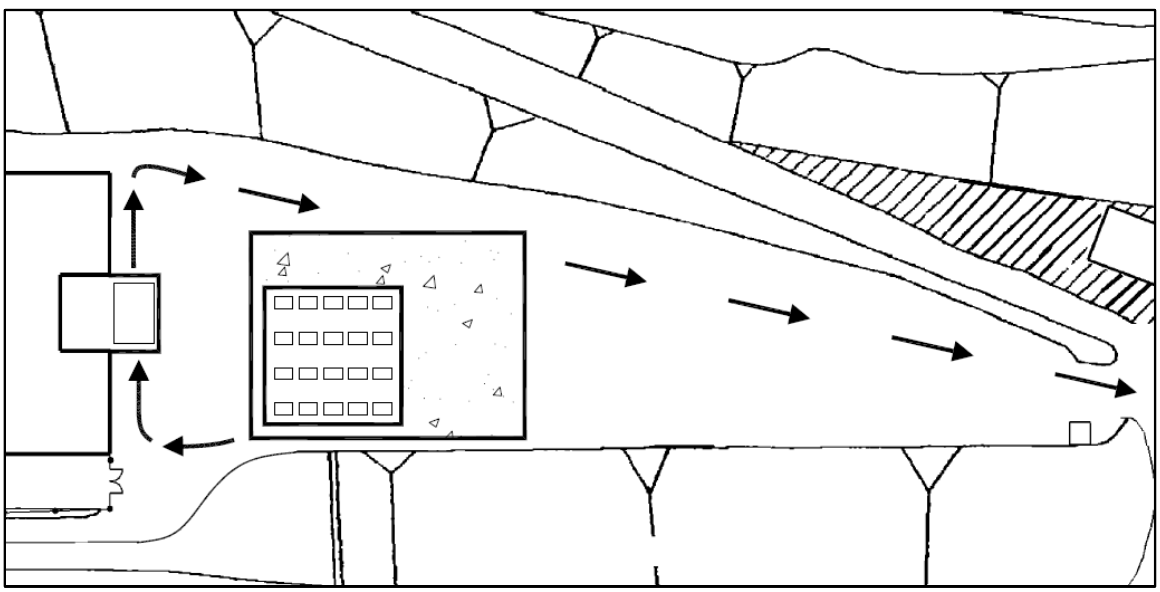


Figure 4-16: Parking Lot 8 Intermodal Storage and Staging Area



Utility Modifications

During decommissioning activities, site utilities will need to be modified to support changing conditions. Electrical load centers will need modifications to support new structures and equipment such as portal monitors or radiation assay equipment. To support building demolition, telecommunications equipment will need to be relocated. Fire water lines will need to be moved to accommodate demolition and/or waste management activities. To support facility modifications, utilities may need to be added or upgraded to meet the intended use.

Fire Water

The Fire Protection Program defines the fire suppression requirements for the site. As decommissioning proceeds, fire suppression needs will change, and system modifications will be required to support building isolation. However, some modifications to the fire protection system will be required for other reasons, such as the removal of obstacles (interferences). For example, 26 above-ground Post Indicator Valves (PIV) inside the main PA and next to the power block will be modified to a below-grade type actuator to prevent interference with demolition activities and civil changes needed for decommissioning (e.g., roadways, haul paths, staging areas, etc.). In addition, approximately five fire hydrants and associated underground piping also will be relocated as part of the PIV modifications. See Figure 4-17 below for an overview of the PIV and hydrant locations.

Figure 4-17: Firewater Post Indicator Valves and Hydrants

Domestic Water

Fresh potable water is supplied to the various buildings on-site to support habitation and processes performed within the buildings. Building demolition or new construction to support decommissioning staff may require new services or modifications to existing services.

Water supply piping will be built to provide water service at several new facilities. Trenches will be excavated from existing water supply piping lines, valves, and connections established for future building construction. Three of these buildings are:

- New alternate RCA Access Facility
- New environmental count room in Building 113
- New ISFSI Security Building

The Alternate RCA Access Facility will provide restrooms, and emergency showers for site personnel and is composed of five interconnected trailers located on the northeast corner of the Building 104 foundation pad. Building 104 will be demolished above ground, and the foundation pad maintained for staging and the Alternate RCA Access Facility. Water supply piping will be routed from a 6-inch diameter underground water main located east of the Cold Machine Shop (Building 116). The new piping will be located below grade -- requiring excavation, valves, backfill, and compaction.

The environmental count room will be installed inside the FLEX Building (Building 113) and requires water for sampling and mixing various materials. The laboratory will have an emergency eye wash station to conform with Occupational Safety and Health Administration (OSHA) compliance for chemical use. The water supply piping for the environmental count room will tie into the existing Fire Station water supply line.

The ISFSI Security Building is a new structure that requires water for restrooms, kitchen, and sinks. This building's water supply will be routed from an existing 6-inch diameter underground water main located near the west reservoir. The new piping will be located below grade -- requiring excavation, valves, backfill and compaction.

Telecommunications

TCOM / IT equipment and services will be required for the duration of the decommissioning project and for as long as the ISFSI remains. During the project life cycle, demolition of structures will require removal, relocation, or installation of new IT equipment and their associated conduits and circuitry. Building demolition schedules will dictate when the modifications become necessary, which will require interface with SI. Some of the structures that house communications equipment that will need to be relocated include:

- Administration Building Assets (Bldg. 104)
    - ☐ 1st Floor and 6th Floor Communications Rooms
- I&C/Medical Facility Assets (Bldg. 102)
    - ☐ 1st and 2nd Floor Communication Rooms
- Met Tower Building Assets (Bldgs. 106 and 107)
    - ☐ UDN (Utility Data Network), plant and County radio, and major copper and fiber hub
- Unit 1 and 2 Turbine Building Assets (Bldg. 101, Elev. 128')

- ☐ U1 and U2 Communication Rooms
- 500kV Yard Control Building Assets (Bldg. 301)
  - ☐ UDN backbone and microwave to off-site

Communication assets and major fiber hubs from inside the structures identified above will be relocated to Building 109. This includes the excavation of trenches, installation of conduit, installation of new cabling, relocation of existing equipment, and the installation of new equipment. Building 109 was selected because of its existing first floor communications room that can be expanded if required. Significant communication assets exist in the building because it currently supports the control room simulator that will be dismantled during decommissioning. Some of these assets include improvements installed in 2015, including the A/C cooling and continuous power UPS unit. This UPS was designed to power the entire simulator machine and room lighting for eight hours with no other building power and may become useful for the new expanded communications room.

In addition, Building 109 is one of the last buildings to be removed in the demolition sequence because it provides on-site decommissioning staff with a kitchenette, conference rooms and office space. Site communication assets will be significantly reduced before Building 109 is demolished. The remaining assets will transition to the ISFSI Security Building.

Storm Water Modifications

Control of storm water run-off is required by state and local regulations and is controlled by permits. During decommissioning, the site characteristics are intentionally changed. Further, decommissioning activities may release or generate contaminants such as oils that would enter the drainage streams and require controls. Storm drain locations that interfere with underground commodity removal will require relocation and/or modification. In addition, storm water management improvements may be necessary in conjunction with infrastructure changes. Building demolition and the establishment of staging areas and road way or haul path modifications will affect site grades. Runoff control structures as well as storm water collection will be needed to support decommissioning.

The existing site conditions at an operating plant are not conducive to full scale construction / decommissioning projects to maintain compliance with California Construction General Permit and local Planning / Building Department requirements. To maintain compliance with these requirements, a progressive preemptive plan and a SWPPP will be implemented. Modifications will include the installation of SWPPP commodities such as curbs, gutters, straw wattles, drainage ditches, piping, and revised grading to provide diversion and catchment of storm water to existing approved discharge points before planned activities. Implementing these modifications will ensure a steady work flow and maintain environmental compliance.

Specialty Equipment

Truck Scales

Moving waste material from DCPP to storage or disposal locations is costly, labor intensive, and highly regulated. Disposing of decommissioned materials includes handling and packaging costs, cost for truck transport via public highway to a railhead in San Luis Obispo or Pismo Beach, and rail transport, or truck transport to an approved off-site location. See Section 4.1.1.7.1 for Waste and Transportation Management.

Keeping an accurate account of waste material is crucial to monitor and control costs and efficiencies. High quality precision weighing equipment is necessary to provide this control. Weight information is the key to tracking the amount of waste collected, monitoring inputs and outputs during materials recovery, and properly disposing of waste. The decommissioning project will place a strong emphasis on waste management, and an appropriate weighing system will be required for optimizing loads and maintaining compliance with transportation and waste facility requirements.

Truck scales are the most versatile weighing system for monitoring waste volumes and tracking shipments. They also ensure DOT compliance for safe and legal transportation. Three sets of truck scales will be installed at DCPP to support decommissioning activities at the south end of the site in Lot 1, in parking Lot 7 next to the waste handling area, and in the south end of Building 115 (Waste Handling Building). These scales will have remote monitoring and recording capabilities consisting of video cameras, video capture, and remote weight recording stations to record an accurate account of time and weight of outbound trucks for waste shipment records. There will be two at each location to avoid delays caused by scale maintenance and repairs. These attributes will allow the waste management group to consistently and accurately weigh materials, mitigate scale breakdown, and avoid costly fines or violations.

Portal Monitors

Decommissioning activities require the removal of equipment, systems, and structures to complete the final stages of a nuclear power station's life. Large volumes of waste material are produced during the decommissioning of nuclear facilities. Some of this material has the potential to be suitable for conventional disposal at a non-radiological disposal facility. Radiation portal monitors are designed to detect low levels of radiation in vehicle loads as they are driven between the detectors. Each system uses infrared sensors to detect a vehicle's presence and switches from monitoring background radiation to checking for an alarm. Radiation portal monitors are used at waste facilities to detect radiation sources mixed among scrap that could contaminate a facility and potentially result in a cleanup.

At Rancho Seco Nuclear Power Plant, two different incidents caused the radiation monitors at scrap yards to reject truckloads of scrap metal. In one case, a small area was inadvertently missed in the survey process. In the other, a second survey of the waste showed that a small amount of activity (below levels that could be detected by normal survey procedures) was distributed over many pieces, causing the scrap yard monitors to trigger an alarm. In both cases, the activity levels were not high enough to cause concern over unmonitored exposure to the public. The resulting corrective actions included survey procedure revisions and extensive training on the procedures. A truck monitor, which was also purchased, performed a final check prior to release to ensure that aggregate quantities were evaluated.

Portal monitors and truck scales are crucial to sustain waste handling during decommissioning. On-site use of the identical make and model detection system as the monitors at the disposal site will ensure acceptance of waste, reducing the potential for rejection. A two-pillar portal monitor with video monitoring will be installed in Lot 1 next to the truck scales. This system will be redundant to reduce the risk of delays caused by equipment malfunction and to account for routine maintenance. Portal monitors are designed to measure background levels. When the monitors sense occupancy, they begin comparing the current count with the most recent background counts. If the count exceeds the most recent background levels, they trigger an alarm. For this reason, it is imperative that they be in an area with low background radiation levels. Parking Lot 1, located at the southeast side of DCPP away from the RCA and waste handling building, was chosen as the best site for the portal monitors.

Assay Survey System

Surveys for reuse of on-site materials such as soil and gravels will require sampling to meet on-site reuse criteria. One way to conduct bulk surveys is by using a Gamma Radiation Detection and In-Container Analysis system. An assay system includes two semi-trailers that house and provide support systems for equipment / instrumentation as well as a transportation means for the system.

Characterization surveys will determine soil classifications for DCPP. Determining soil characteristics for potential radioactive contamination is an extensive process involving evaluations of historical information and available radiological characterization or survey data and a determination of the potential for the impacted areas to exceed the Derived Concentrate Guideline Limits for reuse.

At HBPP the decommissioning team self-performed the site infrastructure development in parallel with nuclear decommissioning of the Unit 3 Structure from 2009 through 2013. Soil reuse for Class 1 and 2 soils began in late 2014. An assay system was installed by the Civil Works Contractor in late 2014. A similar system will be used at DCPP and will be installed next to the truck scales and portal monitors in Lot 1 to support site restoration efforts.

Alternate Access Control

10 CFR Part 20 defines a restricted area as an area where a licensee restricts access to protect individuals against undue risks from exposure to radiation and radioactive areas. The International Atomic Energy Agency (IAEA) defines a controlled area as an area where specific measures or safety provisions may be required to control or limit personnel exposures and to prevent the spread of

contamination during working conditions. The main purpose of an access control is to ensure that only authorized entries into the RCA by properly trained and qualified people are allowed. It is typical at nuclear sites to have computerized RCA access systems to provide direct access to relevant employee information. A robust Radiation Protection (RP) control program will include a database with names of radiation workers, appropriate personal identification information, current dose data, training status, and whole-body counts. A computer-based RCA access control area also will include computer terminals where workers can provide a Radiological Work Permit number, work package number, etc. Personal dosimetry and respiratory protection devices (when required) also will be provided at the access control.

At HBPP, decommissioning activities involved substantial support activities for component removal, waste shipments, operations management, and multiple craft and crew working outside the containment area. A separate access control was necessary to allow support crews to minimize non-essential personnel access inside the Auxiliary Building. The alternate access control installed at HBPP was a modular trailer unit that included five 12’ wide by 60’ long units. The floor structure in one 12’ by 60’ unit was reinforced to support the additional weight of the Personal Contamination Monitors (PCMs) and Small Article Monitors (SAMs). These units were released for disposal pending completion of the Radiological Materials Handling inside the RCA.

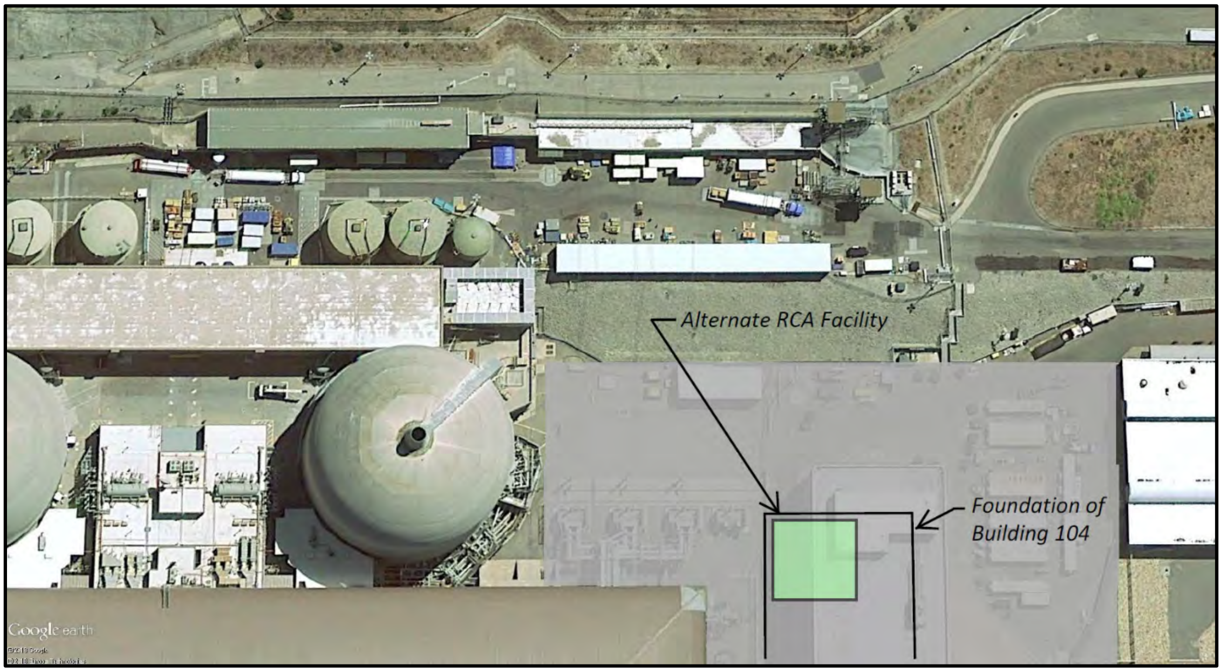
An Access Control Facility is required to monitor and control entry and exit to the RCA until the licensee can demonstrate that the workers are no longer at risk for radiation exposure above 500 millirem per year. DCPP maintains one access control point at the plus 85’ elevation of the Auxiliary Building. This location is anticipated to be maintained as long as practical, according to the building demolition schedule.

An Alternate Access Control Facility will be installed to provide an additional facility for entering and leaving the RCA. The facility will reduce impacts to the critical radiological activities, reduce non-essential personnel on the 85’ elevation of the Auxiliary Building, and provide an alternate RCA access for waste loading and transportation personnel. During removal of structures, systems, and components (SSCs), a substantial amount of waste handling, will take place outside the Auxiliary Building, within the boundaries of the RCA. The Alternate Access Control will provide a secondary access to the RCA without impacting SSC removal activities. This additional facility will remain in place throughout building demolition and waste load out. When the existing Access Control Point on the 85’ elevation of the Auxiliary Building is demolished with the Auxiliary Building, the Alternate Access Control will remain in place until controls are no longer required.

The Alternate Access Control Facility will include locker facilities, restrooms, RP / Foreman office, dosimetry issuance, and log-in / log-out computers. In addition, the facility should include SAMs and PCMs. This facility will require electrical, TCOM, water, and sewer. Modular construction will allow for demobilization or demolition once the RCA boundary is removed.

To limit interference with waste handling, building demolition, and large component removal while still providing access to support decommissioning activities inside the RCA, this facility will be located southeast of the Turbine Building on top of the existing Building 104 slab (following its demolition). Figure 4-18 below shows its location.

Figure 4-18: Alternate RCA Access Facility Location

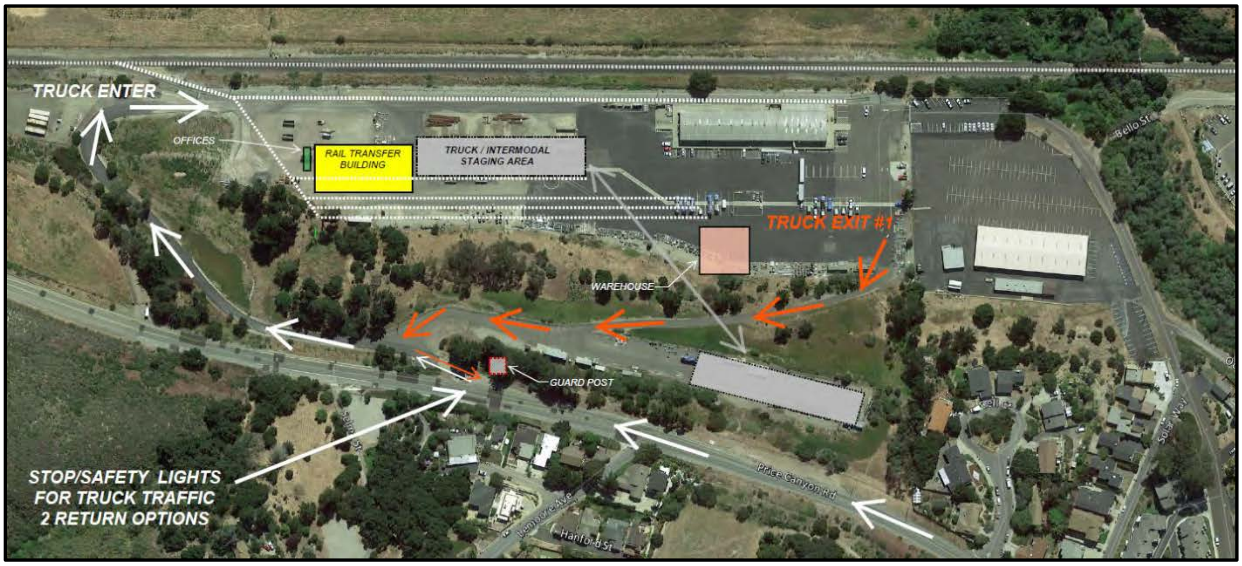


Pismo Beach Yard

Railroad transport is the more efficient method for shipping large quantities of waste material as opposed to truck transport (see Section 4.1.2.4). The Pismo Beach rail spur located near the intersection of Price Canyon Road and Selma Street was built in the early 1970s by PG&E to support construction of DCPP. Known as the Pismo Yard, it will be modified to enable the transfer of intermodals containing waste materials to gondola rail cars staged at the spur. Traditional gondola rails cars have a net carrying weight capacity of 110 tons; or 220,000 lbs. (pounds). The volumetric capacity of a traditional gondola car is 2,743 cubic ft.

The Pismo Beach Yard is located nine miles from the Avila Beach security gate and is the most practical location for railroad transport during the DCPP Decommissioning Project. Trucks bringing intermodals will enter the yard from the entrance on Price Canyon Road and exit the yard via the winding road back to Price Canyon Road (see Figure 4-19).

Figure 4-19: Pismo Beach Yard Layout



Roadways at the yard will be modified to provide adequate space for trucks in the area, the entrance will be widened to accommodate two-way truck traffic, and a traffic signal will be installed to mitigate cross traffic at Price Canyon Road. A truck exit via Bello Road is not considered acceptable because truck traffic would pass through a residential community. The Pismo Beach Yard features include the following:

- Sufficient space for straight and level railroad track
- Rail Transfer Building, which will allow efficient transfer of intermodals to gondola rail cars in a controlled environment
- Multiple rail cars that can be staged on spur lines for efficient transport
- Specialized cranes using grapples that will have designated zones of operation
- Warehouse for spur equipment and an office trailer for site personnel
- Fencing, lighting, and security features

Basic traffic flow requirements identified by the transportation group were:

- Accommodate 50 trucks arriving per day
- Transfer intermodal contents from flatbed to gondola railcar at Rail Transfer Building
- Typically, five trucks equal one railcar
- 10 railcars per day loaded
- Lighting for night operations

Facilities and office requirements identified by the transportation group were:

- Decontamination area for personnel to shower

- Holding tank for liquid radwaste (e.g., drainage collection for emergency shower)
- Air monitoring for radiation releases
- Offices with computer, phone, etc., for clerical and administrative staff
- Small warehouse or shed to store railcar liners, parts, and minor equipment
- Facility lighting for personnel
- Guard shack at inbound gate
- Automated lift gate at inbound road access

The length of track required was determined by the transportation group based on the following parameters:

- Rail track storage at spur:
  - ☐ Three days of loaded railcars
  - ☐ Three days of empty railcars
  - ☐ Total railcars on site at one time is 70
- Rail track required in spur = 4,200 ft.
- Railcars are approximately 60 ft. long
- 70 railcars require approximately 4,200 ft. of track
- Existing track is approximately 1,100 ft. long
- Additional track required for the spur is approximately 4,200 ft. – 1,100 = 3,100 ft.
- Working track is also required for loading facility, moving railcars, building outbound trains, etc.
- Storage track added as needed to meet requirement
- One outdoor track should have access for heavy-lift top-pick machine to load intermodals onto intermodal flatcars. This should include reinforced concrete slab for machine operation, approximately 100 square ft. in size.

Liquid Radiological Waste

The capability to process radiologically contaminated water is a necessary function during decommissioning, and existing LRW facilities must be removed from service according to the project's demolition schedule. The existing radiological water processing equipment will be secured after approximately 18 months after both units are shut down; until that occurs, much of the liquid radiological waste inventory will be processed through this system. Because the water volume in the SFPs will need to be maintained for approximately seven years after both units are shut down, a LRW system will be necessary to dispose of the SFP water after the last of the spent fuel is moved into dry storage. In addition, the reactor cavity for both units will be filled to support reactor vessel internals segmentation, and this water will need to be drained, processed, and discharged after segmentation is completed, approximately seven years after shutdown. Since the existing equipment would have been removed from service, installation of a temporary LRW system will allow preparations to begin for demolition of installed plant components while still providing on-going support for disposing water from the SFPs, disposing water from the reactor cavities, and LRW processing of additional contaminated water because of demolition and site restoration needs.

To best meet LRW-processing needs during decommissioning, a two-phased approach will be used. In both phases, a combination of filters and demineralizers will be used to remove the radionuclides to levels that are acceptable for discharge. Tritium levels cannot be lowered through standard filtration or demineralization, so mixing with ocean water is a way to lower overall concentrations prior to discharge to the ocean. The discussion on maintaining a way to dilute tritiated water during decommissioning is addressed further in the dilution and discharge sub-section below. In Phase I, the existing in-plant LRW system will be used to process and discharge LRW volumes. In addition, to help reduce the required dilution flow needed for tritium discharges after fuel is removed from the SFPs, the SFP will be purged with clean borated water. Use of the existing in-plant LRW system is planned for approximately 18 months from the time both units are shut down until the SFPI modifications are installed and the ASW pumps are removed from service. In Phase II, a temporary system will be installed to process LRW from the time when ASW pumps are removed from service until the Discharge Structure demolition begins. When Discharge Structure demolition begins, the temporary LRW system will be removed, and any additional LRW that is collected will be managed by the Waste Management and Disposal scope of work.

The existing LRW system is located throughout the Auxiliary Building and is primarily situated between the two units. Discharge from the LRW system is routed through the Auxiliary and Turbine Buildings to the Discharge Structure, where it is discharged to the ocean within the limits of 10 CFR 20, Appendix B. Once the existing LRW system is removed from service, the temporary system will be installed in Bay 1 of Building 117A located in the RCA. The temporary system will use the Refueling Water Storage Tanks as a holding tank and temporary pipes will be routed to the Discharge Structure to discharge LRW effluent. With this temporary LRW system, radiological monitoring equipment will be put in place and sample ports will be provided to monitor the constituents of the influent and effluent. In addition, a dilution system will be put in place to dilute tritium concentrations before the LRW effluent leaves the Discharge Structure. The mobile LRW system can be relocated to support a change in the demolition schedule.

The existing in-plant LRW system will be used to process and discharge as much LRW as possible before the loss of the ASW pumps. The decommissioning schedule plans for loss of ASW pump function approximately 18 months after Unit 2 is shut down. As such, the major LRW processing scopes in Phase I include:

- Draining and processing LRW in all plant systems
- Draining and processing reactor and reactor cavity water after core is offloaded
- Purging SFP inventory to reduce tritium concentration

The temporary LRW system will be used after the ASW pumps are shutdown, until the Discharge Structure is ready for demolition. This period will last approximately 18 months to eight years after Unit 2 is shut down. The major LRW processing scopes in Phase II include:

- Processing and discharging storm water accumulation in the Auxiliary Building
- Processing reactor cavity water after reactor vessel internals segmentation is complete for each unit
- Draining SFP water after pool contents have been removed for each unit
- Processing water collected by the Ground Water Treatment System (GWTS) found to be contaminated

After the temporary system is removed, any LRW inventories that are collected will be disposed of by the Waste Management and Disposal scope of work. These sources of potential LRW include:

- Disposing of water collected by the GWTS found to be radiologically contaminated
- Any LRW inventories not otherwise processed by the in-plant or temporary systems

Various project risks were considered during development of the LRW plan. The main risks centered on the availability of a discharge path to the ocean and adverse changes in regulations on releasing radionuclides and other constituents in the effluent. The risk to the LRW plan presented by the discharge path is the availability of permits and rights to discharge LRW overboard. If discharge options are not available, LRW would need to be trucked off-site. The risk to the LRW plan is that regulations will be updated tightening discharge limits on radionuclide concentrations. To mitigate this risk, processed effluent discharge rates will be adjusted to take advantage of available dilution. Additional filtering or demineralizing may be required to meet discharge requirements.

The options considered for processing LRW at DCPP included the shipment of LRW and processing of tritiated water through a Modular Detritiation System (MDS). Off-site shipping of LRW is expensive and inefficient and not a desirable solution unless there is no available discharge method onsite. It is estimated that it would take approximately 440 to 770 trucks each with a 5,000-gallon capacity to ship all LRW rather than to discharge it. Depending on the amount of radioactivity for each of these shipments, the price ranges from $30,000 to $70,000 per truck load.

Safety and environmental impact were considered throughout development of the LRW plan and were major drivers in the evaluating different options for LRW processing. Off-site shipment of LRW involves the use of trucks to ship LRW, which increases the risk to personnel safety. The transportation of LRW increases the overall environmental impact through the pollution and carbon emissions associated with trucking and/or rail transport. Furthermore, additional handling of LRW increases the risk of spills or accidents.

The cost associated with the LRW system depends on the amount of water that needs to be processed, radionuclide concentrations, and the number of particulates in the water. Another factor is whether the water needs to be shipped off-site or discharged. This DCE maximizes the use of in-plant equipment by scheduling the majority of LRW volumes during Phase 1. It allows efficient LRW disposal with equipment that requires no setup as the systems are plumbed. While LRW volumes are being discharged during

Phase I, setup of the temporary equipment may be done in parallel to help ensure a smooth transition to Phase II.

Ground Water Treatment System

A GWTS is needed to remove, contain, test, and process stormwater accumulations and groundwater intrusion into excavations to preclude delays in work schedule due to work area submergence. This water may contain high levels of turbidity and be subject to pH-excursions, both of which are likely to exceed permit limits for discharge. Groundwater management at DCPP is not a typical issue for the operating plant except in limited quantities. However, decommissioning activities will present a need for enhanced groundwater management capabilities due to open excavations and other site changes. Groundwater that is collected will need to be processed to meet discharge limits before it's discharged to normal effluent pathways.

The GWTS for the decommissioning project will be a modular system with mobile components. The mobile components of the GWTS will be located so that they do not interfere with major work activities and will be able to move around the site as needed. The list of components consists of Frac tanks (mobile water processing tanks), hoses, and pumps. The amount of equipment for the GWTS was based on a 10-year, 24-hour storm event. If weather forecasts predict a storm larger than the design basis storm event, which may result in an excavation overflowing, additional GWTS equipment may be readily obtained. Water collected by the GWTS will be tested for radionuclides, and any water found to be radiologically contaminated will be directed to the LRW system for processing radionuclides. Water found to not have radiological contamination will be processed by the GWTS to meet discharge permit requirements and discharged accordingly. The system will be primarily on stand-by and mobilized when storms are predicted or when groundwater is encountered. The same inventory of equipment will be used to keep dry the areas behind the cofferdams for both the Intake and Discharge Structure.

Development of the GWTS plan considered risks related to water accumulation levels and site characteristics. Groundwater and rainwater accumulation cannot be estimated with precision due to the variability of rain events and total rainfall per year. Groundwater estimations are projected to be minimal based on historical records. However, a detailed investigation is planned for the beginning of the decommissioning project to validate the location of the water table and to perform soil characterization. In addition, engineering investigations into the design of the cofferdams for the Intake and Discharge Structures will investigate the amount of seepage expected in the areas behind the sea walls. A geotechnical investigation will be completed to define the depth to dredge line and the depth to a low permeability layer below the excavation level, and to confirm hydraulic conductivity.

Benchmarking performed at the HBPP decommissioning project highlighted the need for early planning for a GWTS. Early planning will provide time to design and implement a functional GWTS and to obtain the required permits. Benchmarking at Vermont Yankee highlighted the need to consider rainwater and/or groundwater infiltration into buildings or excavations. Vermont Yankee experienced a large amount of groundwater infiltration into its reactor building after its shutdown. It's suspected that while the plant was operating, the heat from the plant evaporated any groundwater accumulation that was seeping through the concrete walls. After its shutdown, groundwater intrusion infiltrated the building at a rate of a few hundred gallons per day with intermittent spikes of up to 1,500 gallons of groundwater per day. This groundwater was identified to be radioactively contaminated and Vermont Yankee shipped the water off-site. Although historical documents do not indicate a problem with ground water intrusion at DCPP, the lesson from this is that the water found in excavations must be monitored for radioactive contamination to verify that additional processing is not needed.

On-site water processing options could include filtering, treating, and discharging to the ocean via approved release paths or released to the land through filter bags. Alternately, the water could be tested, filtered, and reused on-site to fill the water reservoirs or used for dust mitigation. Provided the required permits are obtained for release to the ocean or lands, this option requires a minimal amount of new infrastructure and is a reliable way to dispose of the water.

Safety and environmental impacts were considered in the system design and evaluation of options. The GWTS will include requirements for testing to ensure the effluent meets environmental limits before discharge. The safety and environmental impact of the off-site shipping option would pose increased personnel safety risks and environmental impact due to increased vehicle traffic. Radiological safety also was considered, and water that is found to have radionuclides present will be processed on-site through the LRW system.

The GWTS cost includes equipment (filters, hoses, pumps, and frac tanks), fork lifts and labor to move GWTS components around the site, permits for water discharge, and costs associated with water testing. The scope of required GWTS equipment may change based on groundwater testing completed during decommissioning.

<u>Dilution and Discharge</u>

Various on-site water systems during decommissioning will require a system to circulate ocean water to provide a way to dilute and discharge waste waters. The operating plant relies on the cooling water system to flush waste water and provide an adequate dilution volume for brine discharge from the desalination plant and liquid radiological waste water. The shutdown of both units will decrease the amount of cooling water used at the DCPP site and may eventually result in a zero-discharge mode of operation for the facility. Large quantities of radioactive water will be present in reactor coolant systems and SFPs when operations cease, and this water will need to be processed and discharged. In addition, throughout the decommissioning process, more water will accumulate to support decontamination and demolition activities. All of this water must continue to be controlled within regulatory and permit requirements. Dilution and discharge considerations include disposal methods for tritiated water and NPDES compliance with brine dilution related to desalination plant operation. Discharge sources considered for use of the dilution and discharge system during decommissioning are:

- Within 18 months of Unit 2 shutdown, sources include LRW effluent from initial primary system drains, processed sanitary effluent, system drains, Turbine Building sump, and brine from the desalination plant.
- After 18 months but before fuel is removed from the SFPs and RVI segmentation is completed, sources include miscellaneous LRW discharges, processed sanitary effluent, GWTS effluent and brine from the desalination plant.
- After fuel is removed from the SFPs and RVI segmentation is completed, sources include processed reactor cavity water from both units, processed SFP water from both units, GWTS effluent, and the brine from the desalination plant.

Dilution equipment infrastructure will be located at the intake cove. From plant shutdown through a period of approximately 18 months, the ASW pumps located in the intake structure will continue to provide dilution flow. The ASW flow-path through the CCW heat exchanger located in the Turbine Building also will be maintained during this time. Eighteen months after both units are shut down, the ASW pumps and associated flow path will be secured to begin preparations for their removal. At the 18-month milestone a temporary system, consisting of barge-mounted pumps and aboveground piping, will be installed to replace the function of the ASW system. Accompanying piping, tanks, and electrical equipment will be located along the shore of the intake cove and in other locations out of the way of decommissioning traffic. The Discharge Structure is the current discharge point, and that will be maintained until the water from the SFP and reactor cavities is processed by the liquid radiological waste processing system and discharged. Approximately eight years into decommissioning, after the water is discharged from SFP and reactor cavities, demolition of the Discharge Structure will begin. The existing discharge permit for DCPP identifies a discharge point just north of the intake cove. This discharge point is identified as discharge point 003. Once the Discharge Structure becomes unavailable, the dilution and discharge system will be rerouted to discharge point 003. The piping run to discharge point 003 and the barge pumps will remain in service until the desalination plant is removed from service at around the time site restoration activities are completing (approximately 2039). However, before 2039, the demolition of the breakwaters will begin, rendering the barge-mounted pumps unusable. Before the breakwaters are removed, an alternate suction path will need to be established.

The capability to process radiologically contaminated water is a necessary decommissioning function. For liquid radwaste, providing an adequate dilution flow will ensure that LRW effluent will be discharged at a maximum flow rate while meeting 10 CFR 20 Appendix B limitations. Tritium levels cannot be lowered through standard filtration or demineralization, so mixing it with ocean water is a way to lower overall concentrations before it’s discharged to the ocean. If dilution flow is low, then the amount of tritiated water that may be processed would have to be lowered to ensure that the mixed effluent will be below regulated limits. The lowering of the effluent flow rate may impact the schedule for discharging waters. As a result, these delays may interfere with the execution of subsequent decommissioning activities. In addition, the dilution and discharge system will need to provide sufficient dilution flow to dilute the brine from desalination plant to regulatory limits. If dilution flow is too low, then the amount of fresh water production would have to be lowered.

Risks and challenges to the dilution and discharge plan are related to regulatory risks and project schedule issues. If the State Lands Commission lease for the Intake and Discharge Structures is not renewed or if new restrictions are imposed that make execution of this plan prohibitive, then other alternate plans would have to be pursued. These alternate plans include the trucking of water, which is described further in Section 3.1.6.1. If the Intake and Discharge Structure are not available for use as planned due to changes in the project demolition schedule, this plan will need to implement alternate methods to manage water.

Benchmarking performed at both SONGS and Vermont Yankee showed that both sites initially elected to become zero liquid discharge sites. As previously discussed, this decision has caused a significant amount of off-site shipping to be required for Vermont Yankee, especially due to its groundwater infiltration issues. And while SONGS went down the path of becoming a zero-liquid discharge site, it reversed course and elected to reinstate a discharge path. Both examples were considered when developing the plan for DCPP and contributed to the decision to pursue the retention of a discharge path to support decommissioning activities.

The dilution and discharge plan considered various options, including extended use of the ASW system, off-site shipping, and forced evaporation. It was decided not to keep the ASW system running longer than proposed in this report, because a large amount of infrastructure is required to support continued operation of these pumps. ASW operation prevents the removal of installed plant systems and structures, including the intake structure, CCW Heat Exchanger, and Turbine Building. Shipping waste water off-site was considered, but this was not chosen as the primary option since it requires a relatively large amount of trucks. Forced evaporation was considered in lieu of dilution and discharge. However, this option would require $6M to $8M for a new system to process 100 gallons per minute (gpm); it also would be costly to maintain, require specialized labor, and demand a large amount of energy.

The safety and environmental impact of these options was considered, and both the off-site shipping and forced evaporation options presented concerns. The increased truck traffic is undesirable from both a safety and environmental perspective. The potential for disturbance of additional land for a forced evaporation system is also undesirable from an environmental perspective. In both cases, the additional handling required would increase the potential for spills and accidents.

Fresh Water Supply

A fresh water supply will be required on-site to support decommissioning activities. The availability of fresh water is required to support potable water for site personnel, water for dust suppression, making concrete/grout, fire suppression, radiological shielding from the reactor shielding, and a source for make up to the SFPs. This fresh water source is needed from the start of decommissioning through ISFSI site restoration. Currently the main water supply is from the desalination facility with supplemental water provided by Well 0-2. Operation of the desalination facility relies heavily on site infrastructure that will need to be removed for decommissioning. This includes the Intake Structure and some equipment housed within the building, which is scheduled for removal during decommissioning. As a result, infrastructure to support continued operation of the desalination plant will need to be either modified or replaced by new equipment. Well 0-2 is a source of water that is currently used to support plant operation but is subject to drought conditions and is not considered a reliable source of water to support the large number of decommissioning activities.

To keep operating the desalination plant, regulations require sea water to be fed to the plant and that there be a way to dilute the brine discharge from the desalination plant. The Intake Structure is planned to be removed, which includes the bio-lab pumps that serve as feed pumps to the desalination plant and the ASW pumps that are currently relied upon to dilute the brine discharge. A set of pumps will need to be installed to provide sea water feed to the SWRO and will be installed on the same barge where the dilution pumps will be installed. The location of these pumps will be in the intake cove in an area away from the intake structure. The need to install pumps away from the Intake Structure is due to the installation of cofferdam around the structure, eliminating direct access to the ocean. Installing the pumps in an area away from the intake will not interfere with the removal of the Intake Structure while allowing continued generation of fresh water. As noted in the dilution and discharge discussion below, the discharge piping will be relocated from the Discharge Structure to discharge point 003 to allow the desalination unit to keep operating. When demolition of the breakwaters begins, the suction source for the dilution and discharge system will need to be redesigned so that it takes suction from an area outside the intake cove. This is because removing the breakwaters would cause excessive sediment to be suspended in the suction of the sea water feed, creating problems with desalination plant operations. Specifically, this sediment becomes entrained into the feedwater to the plant, which then clogs the filters much faster than normal. In addition, the barge would not survive large storm events because the breakwater would no longer be there to protect it.

As decommissioning progresses, site population and water needs will decrease. However, site restoration activities start late into the decommissioning project and require a large amount of water. This large amount of water is still required for dust suppression, soil compaction, planting, and remaining personnel. As site restoration activities are completed, water needs will be met by trucking fresh water on site and shipping waste water off-site. This will occur through ISFSI site restoration.

Risks and challenges to establishing a fresh water supply are related to regulatory risks and project schedule issues. This plan will be impacted if the State Lands Commission lease for use of the intake cove is not renewed and/or if an adequate discharge point is not allowed and if new restrictions are imposed for using the desalination plant. This plan also will be impacted if regulatory requirements for the siting of a new dilution flow and sea water feed supply system are prohibitive

Alternatives for fresh water supply were considered -- installing a pipe from Avila Beach to the DCPP site, trucking in freshwater, and installing additional wells. In addition, there is some possibility that the project may experience delays due to imposed water restrictions. For trucking water in lieu of using the desalination plant, this would be around the same time when the greatest amount of traffic is expected to occur to transport waste material off-site. In addition, the source of the water would be from a local municipality, which if subject to state mandated water restrictions because of a drought, may impact the amount of water available for decommissioning. Finally, the installation of additional wells was considered unreliable because California normally experiences droughts, often making wells unable to provide sufficient quantities of fresh water.

4.1.1.2.3. Site Security Modifications

The DCPP Security Program is a site-wide program; the work scope in this subsection is for the DCPP decommissioning protective strategy for Units 1 and 2 and ISFSI operations. The costs are allocated based on the DCPP security protective strategy that complies with 10 CFR 73.55. The NRC regulations in 10 CFR 73.55 require PG&E to establish and maintain the capability to detect, assess, interdict, and neutralize security threats.

An adversary's mission is to attempt radiological sabotage by disrupting plant operations or destroying plant equipment within the security perimeter. The security perimeter fence is the optimal location to defend against a potential adversary. An adversary's chance of success increases if the security perimeter is located close to or inside on-site buildings or structure.

PG&E began estimating security costs by evaluating security risks and vulnerabilities during decommissioning. A series of reviews and analyses were performed to identify security modifications most likely to mitigate or eliminate potential risks and vulnerabilities, optimize security operations, and reduce security costs. Initially, 10 modifications to the DCPP physical protection system were identified. However, one security modification was removed from further consideration as described below.

To develop a post-shutdown protective strategy, PG&E used a commercial 3D modeling and statistical analysis to identify potential vulnerabilities during decommissioning. The AVERT Software by ARES Corp. has been used to assess potential security vulnerabilities at the U.S. Department of Energy, U.S. Department of Defense, and several commercial nuclear power plants. The AVERT Software is an NRC-recognized tool for performing security vulnerability assessments and is used by several NRC licensees to identify cost reduction measures in security operations. PG&E used the AVERT Software to model the DCPP site interior and exterior features and access points and simulate multiple security threat types. Various security configurations and scenarios were performed to identify potential vulnerabilities at DCPP, including areas where security operations could be potentially optimized. The analysis results were used to determine: (1) the DCPP site security posture between permanent shutdown of the reactor units and the transfer of spent fuel to DOE and (2) the reasonableness of identified security modifications that, if implemented, could optimize security operations, and reduce overall security costs. The results also were used to inform decisions regarding the most effective and beneficial time to implement the security modifications.

The cost estimate to implement the DCPP decommissioning protective strategy is based on federal, state, and local regulations in effect on December 31, 2017. The DCPP decommissioning protective strategy considers implementation of the security modifications. The cost estimate is based on the aggregate cost savings associated with implementing all security modifications in lieu of the smaller cost savings of individual modifications.

PG&E arranged for a third party independent reviewer to assess and determine the reasonableness of PG&E's decommissioning security approach, application of the industry-recognized 3D software, and the 10 security modifications. Except for the relocation of the Main Warehouse PA boundary modification (10th modification), the third party independent reviewer concluded that nine of the proposed security modifications would improve security response times, reduce interior response positions, and enhance security's ability to neutralize potential adversaries before they reach a target set location. The independent reviewer concluded that relocating the Main Warehouse PA boundary modification was unlikely to result in more efficient security operations or reductions in security staffing. As a result, the cost estimate is based on nine security modifications. The benchmarking of Vermont Yankee, Zion, SONGS and Crystal River found that several made security modifications to gain efficiencies and reduce security staff (References 4.1, 4.2, 4.3, and 4.4).

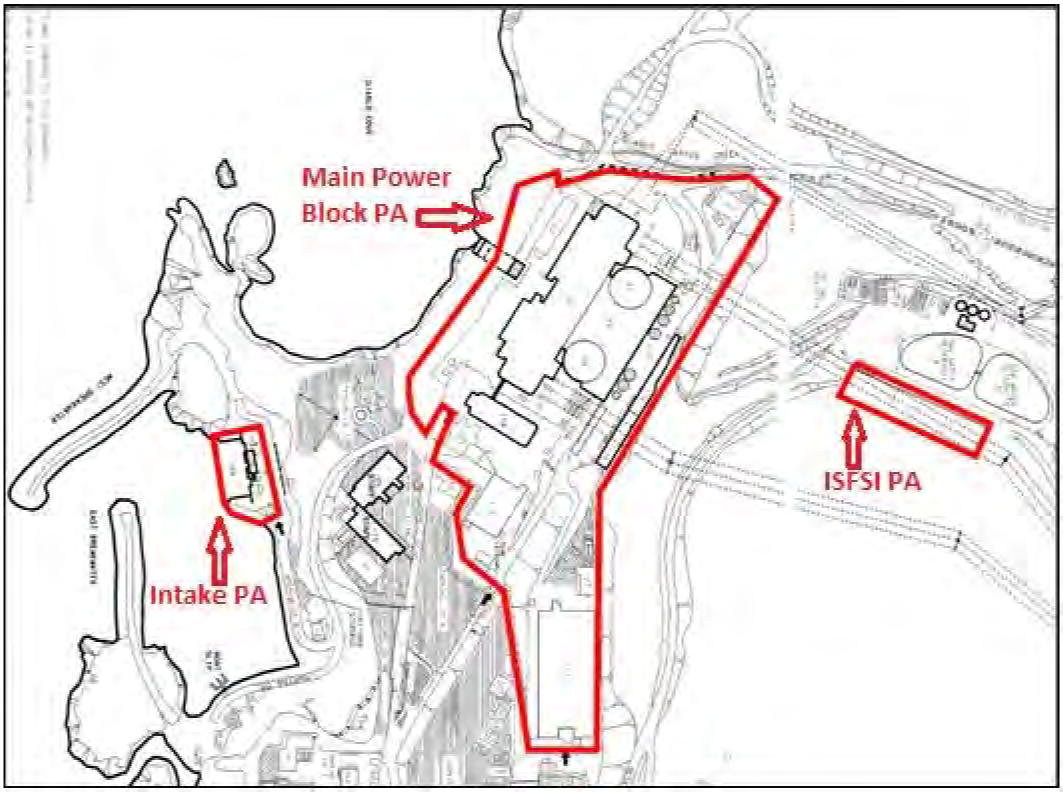
The DCPP decommissioning protective strategy and supporting security plans require NRC review and approval prior to implementation. The NRC decommissioning rulemaking is currently underway to streamline the decommissioning process by incorporating into the regulations commonly requested changes to NRC reactor licenses after permanent shutdown and defueling. The revised regulations would provide regulatory relief for implementing security-related changes, based on the reduced risks associated with decommissioning. The NRC rulemaking is expected to take effect in 2020. PG&E plans to update the cost estimate for plant modifications and security staffing levels after the final NRC rule is issued.

DCPP Security Configuration

Within the OCA, DCPP maintains a physical protection system and security organization to protect identified target locations against radiological sabotage, to prevent the theft or diversion of special nuclear material, and to provide adequate protection of public health and safety from any security event described in the Site Emergency Plan. Administrative and programmatic controls (e.g., criminal history, background checks, Fitness for Duty Program, Behavior Observation Program, Insider Mitigation Program) are also implemented to ensure the physical fitness and trustworthiness of critical employees to perform work.

The DCPP security footprint includes the site access control point, access road from Avila Beach, DCPP Units 1 and 2, ISFSI and other structures. There are three PA locations within the OCA -- the main power block PA, intake PA and ISFSI PA. Figure 4-20 shows the plant layout and PA locations. After the final shutdown of DCPP Units 1 and 2 and transfer of all used fuel to ISFSI, only the ISFSI PA will be necessary. The main power block area will protect against the release of any highly radioactive material, then transition to an industrial security area once that material is removed.

Figure 4-20: DCPP Protected Area Locations



Protection within the PAs includes the capability of equipment and/or armed responders to detect, assess, interdict, and neutralize threats. The protective strategy includes multiple physical barriers, detection, and intrusion equipment, such as fences, walls, key card controls, locked and alarmed doors, Early Warning System (EWS), and Perimeter Intrusion Detection System (PIDS). Security structures or equipment for access control, detection, and communication are key components of the physical protection system. Key structures and components include:

- CAS
- SAS
- Site and PA access points
- Backup power supply diesel generator
- Protected area fencing
- Security building (staffing, incident response support)
- Personnel Access Facility (PAF)

Security Modifications

The security modifications are summarized in Table 4-6 and described in more detail below.

Table 4-6: Security Modifications

Item No.	Security Modification Description
1	Install a 45-degree angled "kicker" to the existing north and west side of the Main PA fence
2	Reconfigure the delay fence inside the PA to facilitate decommissioning efforts pertaining to vehicle traffic.
3	Backfill the intake and discharge tunnels with dirt or concrete for protected/non-traversable pathways.
4	Install delay cages/gates for the personnel and roll-up doors leading into the Turbine Building, Auxiliary Building, and Fuel Handling Building
5	Remove the 140' pedestrian bridge and associated commodities between the Administration Building and the Turbine Building
6	Remove the sheet metal siding skin from the Unit 1 and Unit 2 Buttresses to improve line of sight and enhance the ability to detect and neutralize potential security threats
7	Construct and install four fighting positions (two per unit); each with a sliding gun port
8	Seal six doorways (three per unit) that will not be used during decommissioning
9	Remove overhead transmission lines that are de-energized

A series of reviews and analyses were performed to identify efficiencies and reduce overall security costs. A qualitative review was performed by DCPP subject matter experts to identify plant modifications most likely to result in the largest reduction in security posts. Security posts and staffing are described in Section 3.4. In addition, the results of 3D modeling, simulations and assessments were considered to identify additional opportunities to optimize the DCPP security posture. The results identified 10 proposed plant modifications based on:

- Improving the capability to detect threats
- Removing potential pathways and access for potential intruders
- Improving threat mitigation capabilities

An external company performed a cost estimate on the identified plant modifications (Reference 4.5). The cost estimate was reviewed by PG&E to determine if the proposed modifications would reduce overall security costs. A sensitivity analysis was performed based on factors (e.g., reduced target sets, cost to implement compensatory measures) to inform decisions regarding the most effective and beneficial time to implement plant modifications.

In addition, a third-party evaluation was performed by G4S STS to confirm the reasonableness of the proposed modifications, cost, and schedule. STS is recognized as an industry expert that performs security vulnerability assessment (Reference 4.6). Its subject matter experts have conducted protective strategy reviews at numerous nuclear facilities; provided on-site consultation about all aspects of the NRC's triennial Force on Force program; conducted exploitability analysis for unattended openings and safeguards violations; and supported the development and use of the AVERT system for nuclear-specific design basis threat adversary and security force response. Additional detail describing the 3D modeling and third-party evaluation is provided in Section 3.4.

To reduce security posts, PG&E originally planned to implement a security modification to reconfigure the main PA fencing so that the Main Warehouse would be located outside the main PA. The independent review concluded that the proposed security modification would have a limited cost benefit. Subsequently, PG&E determined that implementation of the main PA modification was not cost effective, and the modification was eliminated from further consideration. The results of the STS review confirmed that the remaining proposed security modifications would improve security response times, reduce interior response positions, and reduce the likelihood of an adversary gaining access to a target set location.

The cost estimate is based on the aggregate cost savings associated with implementing the nine security modifications in lieu of the smaller cost savings of individual modifications. Construction and grading permits may be required before implementing several security modifications. If required, site permits will be obtained. In addition, the volume and types of waste streams generated during implementation of security modifications is expected to be small, except for the debris from removing the pedestrian bridge between the Administration and Turbine Buildings. Details of the nine security modifications are provided below.

- Install a 45-degree angled "kicker" to the existing north and west side of the main PA fence. The modification will support security position reductions and will make it more difficult for an adversary to enter the PA and access a target set. The kicker will be installed during Period 0.

  The "kicker" will be installed and supported from the existing fence. The existing fence structure will be modified, as needed, to support the additional loading from the "kicker." An angled post for the "kicker" will be anchored to the ground (10 ft. or less intervals similar to fence post intervals) with a new concrete foundation. The modified fence will be able to withstand the blast loading determined by PG&E. The "kicker" and concrete foundations will be designed in accordance with the Uniform Building Code (UBC). After installation is complete, the "kicker" will be grounded to plant ground grid and ground rods (off of plant grid). Fencing and grading permits will be required to support this modification. Permitting, design, and procurement activities are expected to be completed before permanent shutdown.

Calculations and drawings will be reviewed and revised, as necessary, to incorporate the kicker and foundation designs, including ensuring that the additional fence sections do not adversely impact the security functions.

- Reconfigure the delay fence inside of the main power block PA to help decommissioning efforts pertaining to vehicle traffic. The modification will keep an adversary in the security sectors of fire for a longer time, allowing security to deter or stop the adversary before entering the PA. In addition, the modification will help decommissioning efforts pertaining to vehicle traffic by allowing the delay fence within the transformer yards to be opened. The delay fence will be reconfigured during Period 0.

  Approximately 70 percent of the delay fence will be portable; the rest of the delay fence, including gates, will be permanently installed. The delay fence barrier will consist of six-ft. tall Cochrane Clear-Vu fence mounted on K-Rails (or lower profile block) with a 24"/20" razor/concertina wire on top. In locations where it's not feasible to place the portable delay fences, Cochrane Clear-Vu fence (height to match portable delay fence) will be mounted to the existing concrete floor/wall or new concrete foundation. For permanently installed delay fences and gates, installation involves excavating for the post footings, setting a post, and backfilling with concrete. Once concrete is set, the mesh panel (Cochrane Clear-Vu style material) will be installed to the anchor post. The delay fence and concrete foundation will be installed in accordance with the UBC. After installation is complete, the delay fence will be grounded to the plant ground grid and ground rods (off of plant grid).

  Calculations and drawings will be reviewed and revised as necessary to address the delay fence and foundation designs, including ensuring that the additional fence sections do not adversely impact the "The Step / Touch potential."

- Backfill the intake and discharge tunnels with dirt or concrete to eliminate unattended openings/traversable pathways. The modification will allow security to reduce some interior response positions. If the modification is not implemented, the unattended openings will require an additional 25 officers to protect new vulnerabilities and perform the associated compensatory measures. Backfilling the tunnels is expected to be completed in Period 1 after permanent shutdown of both units. The intake tunnel for the first shutdown unit will be backfilled with dirt or concrete during Period 0. The intake tunnel for the second shutdown unit and common discharge tunnels will be backfilled with dirt or concrete during Period 1.

  The cross-sections of intake and discharge tunnels are 11'-9" by 11'-9". The tunnels' ceiling volume to the surface will be removed and backfilled with dirt. The proposed location of fill is north of the Met Tower for the intake tunnels and near the grating area for the discharge tunnels. Approximately 25 ft. of each tunnel will be backfilled with Class 'S' soil (150 cubic yards each).

Calculations and drawings will be reviewed and revised as necessary to address modifications to the intake and discharge tunnels.

- Install delay cages/gates for personnel and roll-up doors leading into the Turbine Building, Auxiliary Building, and Fuel Handling Building. The modification will reduce the internal strategy time to interdict an adversary upon entry; give external responders more time to engage an adversary attempting to breach the delay cages; and reduce the likelihood of an adversary gaining access to a target set location. The delay cages and gates will be installed during Period 1.

  Delay cages will be constructed using 2.5” turbine grating (or similar) and will require a roof. A double-leafed gate, scissor gate, or sliding gate near roll-up doors will be installed and anchored to the building floor/wall. For the roll-up doors, an approximately 7~8 ft. double-leafed gate, scissor gate, or sliding gate (depending on space), using chain-link or similar material, will be installed and in the denial position when not in use.

  Personnel cage doors installed outside of the building will require a maglock system with a switch inside the building. The maglocks will hold the cage door open until released by the pushbutton switch. One door’s release will be delayed to ensure proper closure. The maglocks will be powered from the Security UPS by tapping the power at the existing door control units. The remaining doors will have manual controls to hold and release doors. Delay cage doors will be in the open position during normal operation. Delay cages and their foundations installed outside of the building will be designed in accordance with the UBC.

  Calculations and drawings will be reviewed and revised as necessary to address the design of the delay cages and anchors, including the impact on floor and wall loading due to installation of the delay cages.

- Remove the 140’ pedestrian bridge and associated commodities between the Administration Building and the Turbine Building. This will facilitate early detection of a potential adversary and give security a high assurance of neutralizing the threat before reaching target set locations. The bridge removal is expected to be completed in Period 1 after permanent shutdown of both units.

  The pedestrian bridge of the Administration Building is at the fifth floor (El. 140’-8”), perpendicular to the long side of the building and 54-ft. from the west end. The bridge provides an enclosed access from the elevator tower to the operating floor (El. 140’) of the Turbine Building, which is structurally separated. The bridge is approximately 108 ft. long. One end of the bridge is supported by the Administration Building, and the other end is supported at the second panel point from its end near the Turbine Building by a 53-ft. high cross-braced plane-frame, extending from the ground to the underside of the bottom chords. The two legs of the frame are supported by a concrete footing poured on top of and anchored to bedrock.

Existing commodities (conduits, circuits, piping, cabinets, etc.) will be removed, rerouted, or relocated before the bridge is removed. After the bridge is removed, the cut-out (opening) of the buildings will be sealed. Commodities that are related only to the bridge structure will be removed, capped, or spared, as required. These include lighting, PA address speakers, fire sprinklers, security card readers and door controllers, the bridge video surveillance equipment (camera CM-401 and associated monitoring equipment) and the maglock-controlled door subsystem at the entry to the Turbine Building. The remaining commodities include connectivity that must be preserved and reconnected such as radiation monitor sensor circuits, security circuits for the card readers/door controllers to the Administration Building sixth floor computer room, Radiologically Controlled Area fire detector circuits, telecommunications circuits, and 125VDC control power circuits (12kV system). These circuits must be reconnected through new alternative ducting between the Turbine Building and the Administration Building before the bridge structure is removed.

In addition, a new raceway infrastructure will be built down the south end of the Turbine Building crossing underground and up into the Administration Building to replace the existing pathways over the bridge. Once the new infrastructure is in place, circuits that must be preserved can be re-routed. The demolition of the bridge can be completed once connectivity is restored.
Waste volumes generated from the bridge demolition are estimated to be:

- Steel – 65,000 lbs.
- Copper – 2,000 lbs.
- Concrete – 13,500 lbs.

Calculations and drawings will be reviewed and revised if necessary to address the removal of the bridge. Due to physical separation between the bridge and the Turbine Building, no Turbine Building calculation is expected to be impacted by this modification.

- Remove the sheet metal siding skin from the Unit 1 and Unit 2 Buttresses to improve line of sight and enhance the ability to detect and neutralize potential security threats. The siding on the first shutdown unit will be removed in Period 0 and on the second shutdown unit in Period 1.

  Before removing the siding, existing commodities inside the Buttresses that cannot be exposed to the external environmental conditions will be identified and relocated to a suitable location.

The Diverse and Flexible Coping Strategies (FLEX) equipment also will be relocated to the appropriate area. Any equipment and system that is common to both units (such as the diesel fuel oil system) cannot be impacted until both units are shutdown. If Unit 1 siding removal work is started before Unit 2 is shut down, some of the equipment may need to be relocated to the Unit 2 Buttress or other suitable area. After removing the siding, the area will be inspected to ensure that there are no safety hazards that can harm personnel walking near the Buttress. No physical modification will be required to the Buttress HVAC system, and the system will be abandoned in place.

A tenant improvement or commercial/industrial addition/alteration permit is required to support this modification. Permitting is expected to be completed before permanent shutdown.

Calculations and drawings will be reviewed and revised as necessary to address the removal of the Buttress siding.

- Construct and install four fighting positions (two per unit); each with a sliding gun port. Fighting positions are not related to post reductions but they will provide protection for internal responders from an adversary, maintain a good defense in depth, and provide continued high assurance that an adversary can be neutralized. The fighting positions in the first shutdown unit will be installed in Period 0 and in the second shutdown unit in Period 1.

  The fighting positions consist of rolling or swinging steel walls, which are always in open position when not used. Each fighting position will have an opening for personnel access through the hallway that can be closed with a rolling or swinging door (with gun port). The fighting positions will be anchored to the existing wall and floor, and the gun ports will be installed per manufacturer's recommendation. The specific locations of the fighting positions are Safeguards Information (SGI).

  The fighting positions will be built using steel plate meeting UL 752 level. The design and mounting of the fighting positions will be in accordance with the UBC and Design Criteria Memorandum T-3 Structural Design of the Fuel Handling Building Steel Superstructure.

  Calculations and drawings will be reviewed and revised as necessary to address the construction of the new fighting positions in Unit 1 and Unit 2.

- Seal six doorways (three per unit) that will not be used during decommissioning. With fewer travel routes to target set locations, security will be able to execute the protective strategy with fewer responders. The doorways in the first shutdown unit will be sealed in Period 0 and in the second shutdown unit in Period 1.

Six existing doors and all other associated parts inside the Fuel Handling Building will be removed and sealed. The specific locations are SGI. The existing doorways are 3' by 7' or smaller, and the wall is approximately one to two ft. thick. The existing wall will be drilled to install rebar, and both sides of the opening will be formed and filled with concrete to match the adjacent wall. Sealed doors would require a heavy wall breach to enter. Manually-operated "grenade" netting will be installed for doorways that are not blocked off permanently. For the existing doorways with a card reader, the power and signal circuits to the card reader will be de-terminated and the unit will be abandoned in place.

Calculations and drawings will be reviewed and revised as necessary to address the sealed doorways.

- Remove overhead transmission lines that are de-energized. Removing the de-energized overhead lines will eliminate potential pathways for an adversary to access target locations. Compensatory measures are required until de-energized overhead lines are removed. The overhead lines will be removed in Period 2.

  The 500 kV and 230 kV overhead lines will be removed after being de-energized. The Unit 1 and Unit 2 230 kV lines will be de-energized when the Cold and Dark Baywood feed is placed in-service (about 18 months after Unit 1 shutdown). The Unit 1 500kV transmission line will be de-energized when the Cold and Dark southern feed is placed in service (about 30 months after Unit 1 shutdown). The Unit 2 500kV line will be de-energized after transition to a stand-alone ISFSI.

  Design, configuration control, and removal activities that are required for the transmission side will be performed by multiple Transmission Line crews. The transmission towers for the 500 kV and 230 kV overhead lines will be abandoned in place.

  No calculation is expected to be impacted by this modification. Drawings will be reviewed and revised as necessary to address removal of the overhead transmission lines.

<u>Other Security-Related Improvements</u>

a) Early Demolition of Buildings and Structures
Early demolition of the Instrument and Control shop (Building 102), Warehouse A (Building 519) and the attendant buildings in the northeast corner of the main PA are scheduled to be removed during Period 1, as described in Section 4.1.3.2. Removing these buildings will improve the line of sight and ability for early detection of potential design basis threat adversaries, result in a more efficient security posture, and reduce the number of required security posts. Security staffing projections consider post reductions that result from decommissioning activities that are not associated with

security modifications.

b) Install new security building inside the ISFSI PA.

Currently the CAS is in the Turbine Building, and the SAS is in the Security Administrative Building (old security access building); both are within the main power block PA. After spent fuel is transferred to ISFSI, the security requirements in 10 CFR 73.55 no longer apply to the decommissioning reactor sites. As a result, the CAS and SAS will be relocated to a newly constructed building within the ISFSI PA to:

- Ensure that the operation of the CAS and SAS is not adversely impacted by DCPP Units 1 and 2 decommissioning activities
- Facilitate the safe removal and transport off-site the waste generated by Units 1 and 2 dismantled structures and components
- Ensure continued compliance with the security requirements for an ISFSI as described in 10 CFR 73.51

The new security building will include the CAS, SAS, relocated communication system, office space for ISFSI personnel and ISFSI backup power. The construction and cost of the new ISFSI security building are described in Section 4.1.1.2.2.

Schedule

It is assumed that security modifications will be implemented during one of the following four periods.

- Period 0: One unit is shut down and defueled with one unit operational. The duration of Period 0 is approximately eight months.
- Period 1: Both units are shut down, defueled, and spent fuel is stored in the SFPs. However, the spent fuel has not sufficiently cooled so that the probability of a zirc-fire accident is very low. The duration of Period 1 is approximately 18 months.
- Period 2: Spent fuel is stored in the SFPs and has sufficiently cooled so that the probability of a zirc-fire accident is very low. The duration of Period 2 is approximately 5.5 years.
- Period 3: All spent fuel is stored at the ISFSI. Based on PG&E's current assumptions about DOE pickup of spent fuel, the duration of Period 3 is approximately 35 years.

After the first reactor is permanently shut down, implementation of select security modifications may begin on that unit to prepare for decommissioning both units, provided there is no impact on the operating reactor. As decommissioning progresses, adjustments to the DCPP decommissioning protective strategy will consider the creation of or elimination of potential vulnerabilities that result from changes in the physical configuration of the DCPP site.

Efforts will be made to submit the DCPP decommissioning protective strategy and supporting security plans that require prior NRC review and approval to the NRC at least 12 to 18 months before the desired DCPP implementation date to minimize the potential for delays in implementing security modifications.

Construction and grading permits may be required before implementing several security modifications. The schedule for obtaining construction and grading permits, if required, is addressed in Section 4.1.1.9.13.

Modifications Cost Estimate

The security modifications cost estimate includes the cost of the security modifications and the supporting costs for project management and controls. The cost includes the associated cost (labor, material, and fees) for the engineering, design, construction, permitting and document updates. Total cost for security modifications can be found in Table 4-1.

The security modification costs are based on an EPC cost estimate performed by a vendor with security modification experience at DCPP. For each modification, the EPC cost estimate includes the costs for:

- Engineering and design labor
- Work planning
- Construction labor
- Material and equipment
- Miscellaneous hardware to complete installation
- Mobilization and training
- Demobilization

Engineering, procurement, and construction costs for a new ISFSI security building are described in Section 4.1.1.2.2.

Options Considered

Initially, PG&E did not consider changes to the physical security configuration after the first unit is shut down because of the potential adverse effects on the operating unit. However, evaluation of select external modifications (e.g., fencing) revealed that these modifications would have minimal impact on reactor operations, and the total cost savings could offset the costs of implementing the security modifications. As a result, security modifications are planned after the first unit is shut down.

The independent analysis concluded that relocating the Main Warehouse outside of the main PA would not have an appreciable impact on security operations, reducing security staffing, or improving the overall effectiveness of the protective strategy. A cost benefit analysis is needed to identify the additional cost savings after installing the modification.

After permanent shutdown, structures will be removed early to improve line of sight. The Instrument and Control shop (Building 102), Warehouse A (Building 519), and the attendant buildings in the northeast corner of the main PA are scheduled to be removed during Period 1. This will improve the line of sight and ability for early detection of potential design basis threat adversaries. The scope and cost associated with removal of these structures is in Section 4.1.3.2.

4.1.1.3. Decontamination in Support of Decommissioning Activities

Radiological contamination is radioactive material in an undesirable location or present in an undesirable amount. When radiation is either eliminated or reduced to a desirable level, the radiological contamination has been "decontaminated."

Decontamination activities can be viewed as three separate and distinct scopes of work that serve the various phases of decommissioning. These scopes of work include the following activities in chronological order:

- Removal, remediation, and/or abatement of all known hazardous and/or regulated materials in a regulatory-compliant manner before either removing a system from within a structure, removing a large component from within a structure, and/or demolishing a structure
- Preparation of a structure for open-air demolition by limited surface decontamination efforts for either special and/or unique cases
- After demolition is complete, radiological decontamination of the remaining (also termed "residual") surfaces of a structure that will be left in-place. The decontamination will support final status survey operations and the follow-up independent third-party confirmatory surveys before 10 CFR Part 50 licenses are terminated.

PG&E evaluated multiple decontamination methodologies and numerous tooling options to conduct a safe and successful decontamination campaign on a site-wide basis, including pre-removal decontamination, in-progress decontamination, and post-removal/closure decontamination activities. This section provides details on those options, decisions, and the resulting cost estimate. The cost estimate for decontamination of DCPP is provided in Table 4-1.

4.1.1.3.1. Hazardous and Regulated Material

Hazardous and/or regulated materials are contaminants that must be removed from the DCPP site during the license termination and site restoration phases. The accepted industry terminology related to the elimination of hazardous and/or regulated materials is:

- Removal: taking material either away from, or off from, the position/location that the material is presently occupying
- Abatement: ending, reduction, or lessening of something
- Remediation: the action of remedying something by either reversing or stopping environmental damage

PG&E has direct experience with cleaning sites that include spills, fossil plant clean-up, and nuclear plant decommissioning at HBPP Unit 3. As part of the removal, remediation, and abatement processes, PG&E

prioritizes the safety of employees, the public, and the environment. To provide an adequate margin of safety, known hazardous materials are addressed before (1) removing a system from within a structure, (2) removing a large component from within a structure, and/or (3) demolishing a structure.

Waste from decontamination will be classified, packaged, and disposed of in accordance with Section 4.1.1.7. This waste includes hazardous wastes such as asbestos, lead, and various universal wastes.

4.1.1.3.1.1. Asbestos Description and Removal

The term "asbestos" is a generic name for the fibrous variety of six naturally occurring minerals with common characteristics. Asbestos is made up of bundles composed of extremely long, thin fibers that can be easily separated from one another. Asbestos minerals will not burn. In the past, they have been woven and possess high tensile strength, flexibility, and resistance to chemicals, heat, and electricity. Although some products are mostly asbestos, it is more common for asbestos to be combined with other components into an asbestos-containing material (ACM).

When dry, an ACM is considered friable if it can be crumbled, pulverized, or reduced to powder by hand pressure. If it can't, it's considered non-friable ACM. It's possible for non-friable ACM to become friable when subjected to unusual conditions, such as demolishing a building or by physically removing an ACM that has been glued into place.

Asbestos is a known carcinogen. The OSHA standard establishes a classification system for asbestos construction work that spells out mandatory, simple, technological work practices that contractors must follow to reduce worker exposures. Under this system, the following four classes of construction work have increasingly stringent control requirements:

- Class I asbestos work is the most potentially hazardous class of asbestos jobs. This work involves the removal of asbestos-containing thermal system insulation and sprayed-on or troweled-on surfacing materials. PG&E must presume that thermal system insulation and surfacing material found in pre-1981 construction is ACM. The OSHA standard allows for and specifies how one must rebut that presumption. Thermal system insulation includes ACM applied to pipes, boilers, tanks, ducts, or other structural components to prevent heat loss or gain. Surfacing materials include decorative plaster on ceilings and walls; acoustical materials on decking, walls, and ceilings; and fireproofing on structural members.
- Class II asbestos work includes the removal of other types of ACM that are not thermal system insulation such as resilient flooring and roofing materials. Examples of Class II work include removal of asbestos-containing floor or ceiling tiles, siding, roofing, or Transite panels.
- Class III asbestos work includes repair and maintenance operations where ACM or presumed ACM (PACM) are disturbed.
- Class IV asbestos work includes custodial activities where employees clean up asbestos-containing waste and debris produced by construction, maintenance, or repair activities. This

work involves cleaning dust-contaminated surfaces, vacuuming contaminated carpets, mopping floors, and cleaning up ACM or PACM from thermal system insulation or surfacing material.

Individuals involved in asbestos removal, monitoring, remediation, packaging, and disposal require specific training to maintain the skills and expertise in asbestos abatement. PG&E determined that, for a large abatement project, contracting with a specialty certified vendor is the most cost-effective way to complete the ACM abatement in a safe and compliant manner.

Most of the Class I friable asbestos to be removed from the DCPP site will take the form of pipe lagging, pipe insulation, or electrical wire containing asbestos insulation. Consistent with OSHA regulations governing Class I asbestos removal control methods, PG&E will use the glove bag removal methodology for ACM during decommissioning. Simply said, the glove bag method consists of two workers removing ACM in a sealed plastic bag so that it is contained within the bag when removed from a plant component or structure. This type of removal has specific steps that must be taken to comply with both OSHA and NESHAP regulations. OSHA regulations further specify removal or intentional disturbance of ACM is only conducted by certified and trained employees using Personal Protective Equipment (PPE).

Additional ACM found at DCPP includes galbestos metal cladding (Class II, non-friable ACM) that was used on both the Turbine and Fuel Handling buildings (approximately 1,605 tons). Galbestos metal cladding was produced as a corrosion-resistant metal roofing and siding panel. The general manufacturing procedure started with a carbon steel sheet that was then hot dip galvanized. While the zinc was still molten, an asbestos felt was pressed into the surface to form a mechanical bond between the zinc and the asbestos, hence the name galbestos with “gal” standing for galvanized and “bestos” for asbestos.

The sheet was then impregnated with asphalt under pressure and heat. In the resultant sheet, the asbestos fibers were completely encapsulated by the asphalt. A final protective coating of either asphalt or hot, melted, polyester color coating was then applied as the final weathering coat. As a result of this manufacturing process, the asbestos fibers are totally captured and bound in an extremely tight physical matrix.

The unique coating provided a virtually indestructible product in harsh industrial environments. Because of its durability, many installations still exist, as is the case of the Turbine Building and other structures at the DCPP site.

To understand the classification of the galbestos at DCPP, PG&E relied on independent third-party expert opinion and prior work completed at the DCPP Turbine Building Buttresses where galbestos was removed/replaced. During this work, it was identified that galbestos was used. Further, it was determined that the majority of galbestos removed was in a Class I non-friable state and approximately 20 percent of the galbestos removed was in a Class I friable state. For the purposes of decommissioning, it is assumed that the remaining galbestos will have the same percentages of friable and non-friable portions.

Because San Luis Obispo County APCD's regulations require removal of all ACM before building demolition, PG&E will remove galbestos sheeting on the Turbine Buildings and Fuel Handling Buildings before starting demolition activities. Costs associated with the removal of galbestos are shown in Table 4-7 with contingency.

Table 4-7: Galbestos Removal Cost Estimate

	Labor	Material	Equipment	Other	Grand Total
	(in thousands)				
Galbestos Removal	$27,725	$2,050	$3,523	$50	$33,349

4.1.1.3.1.2. Lead Paint Description and Removal

Lead is both a carcinogen and a poison that travels easily in the environment. Lead has been used at the plant as radiation shielding and as an additive in paint. Lead shielding will be disposed of in accordance with Section 4.1.1.7. The lead-based paint will be dispositioned using at least one of the following:

- Replacement: removing the building part with lead-based paint on it and replacing it with a new one (e.g., replacing a window and frame that have been painted with lead-based paint and replacing it with a new vinyl clad window frame)
- Enclosure: covering the lead-based paint with a solid barrier
- Encapsulation: coating the lead-based painted surface so that it is not accessible
- Paint removal: taking off lead-based paint

Enclosure and encapsulation are permanent solutions, but these methods do not remove the lead-based paint; they abate the lead-based paint hazard, so they will not be used at DCPP. Thermal cutting will be used in component removal and other decommissioning activities (see Section 4.1.1.6) and requires lead paint removal, which will account for most of the decommissioning lead work. The lead-based paint must be removed along a proposed cut line before deploying thermal cutting operations to prevent creating an airborne lead hazard during cutting.

Removal methods will create a lot of lead dust and waste. To help mitigate this, work will begin with wet misting and HEPA vacuuming out old building parts. As the work progresses, clean-up of debris will help keep lead dust levels down to the greatest extent practicable. Paint will be removed by using one or more of the following methods:

- Wet scraping down to the substrate
- Wet planing
- Electric heat guns
- Local-exhaust hand tools
- Chemical stripping
- Vacuum and water blasting, limited to exterior use only

Evaluations were conducted on the various options to ensure compliance with EPA regulations. It was determined that wet scraping, wet planing, and vacuum and water blasting do not remove all the lead-based paint or are limited in application. So, these methods will not be used at DCPP. The following are the lead removal technologies and methodologies-of-choice for DCPP decommissioning: electric heat guns, local-exhaust hand tools, and chemical stripping. Each is described briefly below:

Electric Heat Guns

Electric heat guns may be used to force warmed air onto a painted surface. The heat softens the paint. The loosened paint is then scraped off with hand tools.

Caution must be used with heat guns. Heat guns that operate at more than 1,100° F can cause lead-based paint to produce toxic fumes and therefore are prohibited for the removal of lead-based paint. Lead fumes contain many tiny particles of lead that are very easy to inhale. The lead fumes quickly travel deep into the lungs and then into the blood. Heat also can cause the paint to release organic vapors, which come from the chemicals used to make paint. High heat can turn these chemicals into dangerous vapors.

OSHA states that workers should wear a Powered Air Purifying Respirator (PAPR) when using a heat gun to remove lead-based paint. The PAPR should have both a HEPA filter and an organic vapor cartridge. Using a heat gun is a Class 1 task.

Local Exhaust Hand-Held Tools

Local exhaust hand-held tools are power tools that workers can hold in their hand. The tool is confined within a shroud, which has a hose that attaches to a vacuum with a HEPA filter. This system is called a local HEPA exhaust system. There are several local exhaust hand tools for lead removal work. Using local exhaust hand tools is a Class 1 task.

Workers should never remove or pull back the shroud or cover. The shroud and the cover are required for the vacuum system to work properly. Shrouded tools are more difficult to use. The tool must be moved very slowly to keep the shroud in place. The tool also must be used flat against the surface. Working too fast will cause the shroud seal to break, enabling lead dust to get into the air.

Chemical Stripping

The use of chemicals in the form of solvents or caustic paste to strip off paint is called chemical stripping. Chemical solvents dissolve the paint. Caustic paste melts paint into a sticky substance that then can be scraped off with hand tools. Chemical stripping always involves manual scraping. Chemical strippers suited for lead-based paint should be used. Methylene chloride strippers should never be used because they will produce toxic lead fumes. The OSHA guidelines regarding chemical stripping lead-based paint would be consulted before starting chemical stripping operations.

After the lead-based paint has been removed, the surface from which the paint was removed must be cleaned. A special rinse must be used to neutralize the pH of the surface. The rinse balances the acid or base of the stripping chemicals. The rinsing process must be checked with pH indicators to make certain that the neutralizer is working properly.

4.1.1.3.2. Building Decontamination

As mentioned above, after removal, remediation, and/or abatement of all known hazardous and/or regulated materials, there are two remaining scopes of work related to building decontamination.

- Before open-air structural demolition, structures are prepared by applying either a fixative and/or some other form of lockdown media to seal off loose radiological contamination to prevent the migration of loose radiological contamination during demolition activities in the form of airborne radiological contamination.
- After demolition is complete, remaining surfaces of a structure that will be left in-place will be radiologically decontaminated. The decontamination will support final status survey operations and the follow-up independent third-party confirmatory surveys before 10 CFR Part 50 licenses are terminated.

This section describes the possible strategies for decontaminating all buildings on site that could contain contamination so that demolition activities can proceed. Numerous options exist for performing decontamination.

Structural surfaces (concrete or steel) will be radiologically decontaminated to accomplish either of the following:

- Prepare a structure for open-air demolition when the application of either fixative or some other form of lockdown media is deemed insufficient to seal off loose contamination
- Remediate remaining structural surfaces to the site-specific DCGL, thereby enabling and facilitating termination of the 10 CFR Part 50 licenses

Remaining concrete surfaces of impacted structures will be decontaminated by removing approximately 0.25” of concrete either by scabbling or other abrasive means in accordance with the structure’s MARSSIM Classification. Similarly, remaining structural steel surfaces of impacted structures will be decontaminated to a bare bright finish by either abrasive blasting or mechanical abrading in accordance with the same MARSSIM Classification.

4.1.1.3.2.1. Preparation for Open-Air Demolition

As discussed previously, a fixative or lockdown agent will be applied to building surfaces before open air demolition. A wide range of fixative and lockdown agents are available to seal off any loose radiological contamination above the demolition cutoff elevation. Fixative or lockdown agents form an impermeable barrier between either hazardous or contaminated materials or the environment. These agents are applied to any surface to lock down loose radiological contamination and prevent leaching of contaminates after decontamination efforts. Common uses are to stabilize large plant components, concrete, valves, and other problematic radioactive waste equipment before shipment.

Fixatives are also used to control environmental contamination and soil erosion, providing an alternative to the traditional approach of plastic sheeting or tarpaulins. Fixatives may be applied with an industrial airless sprayer, paint roller, or brush. If not pre-tinted, the fixative or lockdown agent selected to seal off any loose radiological contamination should be tinted with a coloring agent that is chemically compatible with the fixative or lockdown agent so that the degree of coverage is readily ascertainable by visually inspecting the treated surfaces.

Benchmarking

Cost benefit analyses of decontamination versus no decontamination before open-air demolition have been generated in conjunction with the Plum Brook Reactor Decommissioning Project, Zion Station's Decommissioning Project and during the development of the bid proposal related to the decommissioning of SONGS Units 2 and 3. The subject cost benefit analyses concurred that it was not cost effective to decontaminate the structural surfaces beyond the open-air demolitions criteria before demolishing a structure. That's because in impacted areas, as defined by the MARSSIM, unless a surface can be decontaminated to a non-detect above background status, the resulting demolition debris will be either Class A waste or 10 CFR 20.2002 RCRA waste (see Section 3.3).

Given the highly unlikely probability of generating any significant, meaningful, quantity of non-detect materials in an impacted area by traditional radiological decontamination means and methods, PG&E has determined that no effort should be made to do so in the interest of cost and schedule.

4.1.1.3.2.2. Remaining Structures' Surface Remediation

As described above, remaining structural surfaces require remediation (further decontamination) to ensure the site-specific DCGL will be met for Part 50 license termination (see Section 1.4). This section describes the remediation methodologies for vertical walls and horizontal floors in remaining structures.

Vertical Wall Decontamination

There are two methods that may be used to decontaminate the vertical wall portions of remaining structures: hand-held scabbling tools or a sponge and abrasive blasting system. The rationale for use of each method is described below.

Hand-Held Scabbling Tools

The most common way to remove fixed contamination from structural concrete surfaces and/or structural steel is a scabbler and/or some form of shaving device. The scabbling of structural concrete surfaces produces a relatively smooth surface that can be readily surveyed by radiation protection technicians. Three hand-held tools are typically used to perform scabbling:

- *Scabbler:* Scabbling is a surface removal process that uses pneumatically operated air pistons with tungsten-carbide tips that fracture the concrete surface to a nominal depth of 0.25” at a rate of about 20 square ft. per hour. A scabbler can be used to decontaminate most of the remaining structure’s surfaces (all flat surfaces) post-demolition. However, there will be a need to use “specialty tools” to decontaminate areas that are inaccessible to a scabbler, as noted below.
- *Needle guns:* Needle guns are generally reserved for areas that have been deemed inaccessible by a scabbler, including, but not limited to, inside corners, cracks, joints, and crevices. The needle gun is a pneumatically air-operated tool containing a series of tungsten-carbide or hardened steel rods. The rods are connected to an air-driven piston to abrade and fracture the surface. The amount removed depends on how long the needle gun is held on the work surface. Typically, one to two millimeters are removed per pass. Needle guns also have proved useful in decontaminating painted and oxidized metallic surfaces.
- *Chipping:* Chipping includes the use of pneumatically-operated chisels and similar tools. Chipping tools are generally limited to decontaminating cracks and crevices in structural concrete surfaces.

For each of the hand-held scabbling tools described above, the abrading component is contained within a shrouded housing that prevents and precludes the dust and particulate matter generated by the tool’s operation from migrating into the environment outside of the shroud. Each tool’s shroud housing is connected via a flexible hose to a HEPA filtration device. The fractured media and dust drawn by the HEPA Filter are deposited into a container that typically is a standard 55-gallon steel drum. The worker closes and seals the drum while the contents remain under negative pressure. Once sealed, the drum can be removed from the decontamination system and a new container put in place.

Sponge and Abrasive Blasting Technology

Sponge and abrasive blasting are similar techniques that use abrading media that has been surface coated with abrasive compounds such as silica sands, garnet, aluminum oxide, etc. The media is propelled onto the surface to be decontaminated by compressed air.

Sponge blasting is less aggressive, incorporating an aluminum oxide-based foam media that, upon impact and compression, absorbs contaminants. The sponge media can generally be collected, cleaned in a centrifuge, and reused several times.

Abrasive blasting is more aggressive than sponge blasting, but less aggressive than scabbling. That said, either of the two blasting technologies can decontaminate 500 square ft. of surface area per hour; that is significantly more productive than a handheld scabbler.

Both sponge and abrasive blasting operations generate significant amounts of dust and other airborne particulate matter. They must be conducted within a negative air enclosure similar in nature to enclosures erected to support asbestos abatement activities.

Based on evaluations of building drawings and decommissioning industry expertise, the DCE assumes that approximately 160,000 square ft. of surface will need to be decontaminated. Thirty-three percent of surfaces being decontaminated would be scabbled using hand-held methods, and 67 percent would use sponge and abrasive blasting. Industry operating experience has shown it is more cost effective to use:

- Hand-held scabbling tools for decontaminating smaller or inaccessible vertical surface areas due to the ease of the methodologies
- Sponge and abrasive blasting technology for decontaminating larger vertical surface areas due to the speed at which the decontamination can take place

Horizontal Floor Decontamination

Different methods and tooling are required for horizontal floor surfaces. Two methods may be used to decontaminate horizontal floor surfaces of remaining structures -- scaling drums or floor shavers.

Scaling Drum

A scaling drum is a miniaturized version of the rotary planer used by heavy highway contractors to remove concrete and/or asphaltic concrete from existing roadways before repaving or replacing them. Generally, a scaling drum is mounted to, powered by, and manipulated by a remotely-controlled demolition tool carrier.

A scaling drum consists of a drum fitted with multiple diamond tipped impregnated cutting nodules. As the drum rotates, it abrades and removes the concrete in an aggressive manner. As a result, its use is limited to decontaminating highly contaminated areas of concrete wherein the contamination has migrated deep into the concrete substrate through cracks and crevices.

Industry operating experience has shown that the scaling drum, in some instances, was effectively used to remove as much as 6" of concrete, in depth, from the floor of the hot pipe tunnel at NASA's Plum Brook Re-actor Facility's decommissioning project in Perkins Township, Ohio. The floor of the hot pipe tunnel was constantly exposed to radioactive water from leaks in the joints of the hot cell drain system that was suspended from the ceiling of the hot pipe tunnel.

Floor Shaver

A floor shaver is a much smaller-sized version of the scaling drum described above and is used to decontaminate concrete floors over large areas that have not been previously exposure to wetted contamination conditions and/or extensive cracking. Typically, a floor shaver will remove ⅛” of concrete surface per pass at a rate of 65 square ft. per hour.

Due to industry operating experience described above and the speed at which the floor shaver can decontaminate, the scaling drum is relegated to decontaminating only those floor areas that are heavily cracked or deteriorated, and where the floor surface was subjected to long-term exposure to radiologically contaminated liquids that may have penetrated deep into the concrete

4.1.1.3.3. NSSS Decontamination to Reduce Dose to Decommissioning Personnel

The Nuclear Steam Supply System (NSSS) is comprised of systems, structures, and components (e.g., pipes, pumps, valves, wires, instrumentation) that take the heat from the reactor, convert it to steam, and use the steam to turn a turbine and generate electricity. Because the heat source was the nuclear reactor, many of the components were exposed to radiological contaminants, so the components are viewed as contaminated.

The focus of NSSS decontamination is to reduce source term. Source term refers to the types, quantities, and forms of the radionuclides present in a system or area that describes the potential for exposure to radiation. Elimination or minimization of this exposure is desirable to keep radiation exposure to workers ALARA. This differs from environmental decontamination which includes the processes that allow a plant site to be released for use by the public or other non-utility entities. Environmental decontamination is discussed in Section 4.1.1.3.

The plan to go directly into decommissioning for DCPP is unique in U.S. decommissioning experience; most other nuclear plants have spent some time in SAFSTOR status before starting decommissioning activities. During the SAFSTOR period at other plants, the quantity of radioactive material present in systems and areas is reduced naturally by radioactive decay. Radioactive decay is the process by which radioactive atoms achieve stability by giving off excess energy in the form of gamma rays, x-rays, or particle emissions such as betas, positrons, alphas, neutrons, or neutrinos. The process is consistent over time and is based on well-established physical phenomenon. The time required for one half of the radioactive atoms present to undergo decay is called the half-life. Radioactive decay is an asymptotic function; one half of all atoms remaining undergo decay each half-life (i.e., 1/2, 1/4, 1/8, etc.). With DCPP intending to immediately begin decommissioning, the plant will not have the same opportunity to undergo a period of radioactive decay. This is of particular significance regarding Cobalt-60 (Co-60); because of its 5.27-year half-life, it will be the primary nuclide of concern for both decontamination and demolition radiation exposure.

By reducing the radioactive source term, PG&E would reduce the potential for decommissioning personnel to receive higher doses from fixed contamination typically associated with corrosion or oxide products on metal. A study was performed to evaluate various methods available for reducing the radioactive source term in contaminated systems exposed to radioactive fluids. This evaluation not only considered the possible decontamination methods, their effectiveness and cost, but also the implications of not performing decontamination of NSSS systems at all. As described below, the study concluded that PG&E will chemically decontaminate specific portions of the NSSS.

Option to Not Perform NSSS Decontamination

Immediately after plant shutdown, physical work will begin in the two Containment Buildings and Auxiliary Building to support future critical path work. Because these work activities will take place before the decay of Co-60, in some cases, significant radiation exposure would occur to decommissioning personnel if no decontamination is performed. Based on the work scopes for these activities in the areas indicated, not performing system NSSS decontamination is expected to result in an additional 526 person-rem. This additional radiation exposure poses potential increase in costs related to exposure of workers to ionizing radiation during their work. The monetary cost associated with occupational exposure is called the "Alpha Value." Based on a 2017 study by the Information System on Occupational Exposure (ISOE) and a review of the average Alpha Values used at recent decommissioning plants in the U.S., the Alpha Value used for this study was $18,483 per person-rem. Based on this cost per person-rem, the cost of not performing NSSS decontamination (i.e., an additional 526 person-rem) would be $9,722,058.

Decontamination Methods

In considering the best method for decontamination, mechanical means and chemical decontamination methods were investigated. A review of plants that have been decommissioned showed that some plants performed full system decontamination, while others did not.

The mechanical methods evaluated include abrasive grit blasting and hydrolazing. Abrasive blasting, while effective for building decontamination, is no longer the preferred method for NSSS decontamination techniques because there are no vendors available to provide this service for full system decontamination. Hydrolazing would not achieve the same level of decontamination as chemical decontamination due to access constraints for certain areas of the system. Thus, the decontamination effectiveness may be lower than chemical decontamination. To achieve similar results as the chemical decontamination, additional labor would need to be used, which would increase the total cost. Due to the void in vendor experience and expertise and reduced level of decontamination, the study determined that mechanical methods of decontamination were impractical.

Chemical decontamination of the Reactor Coolant System (RCS) has proven beneficial at other decommissioned plants. Industry experience was reviewed for both US and international nuclear decommissioning plants to assess the expected benefit of chemical decontamination to reduce the source term of the primary RCS system. There are many different chemical decontamination processes. Some of the more well-established chemical decontamination processes that have been used in multiple applications include:

1.) CAN-DECON and CAN-DEREM Processes (EDTA acid, citric, and oxalic acid)

2.) CITROX Process (citric and oxalic acids)
3.) NITROX Process (nitric and oxalic Acids – PN Services, Inc.)
4.) APCE Process (permanganate in alkaline solution – Russia)
5.) CORD Process (chemical oxidation reduction decontamination)
6.) LOMI Process (low oxidation state metal ion – United Kingdom)
7.) DFD Process (decontamination for decommissioning – EPRI)

Over the years, these processes have been modified or supplemented by various vendors to tailor the process to the unique constituent contaminants in the piping being decontaminated. The chemical processes dissolve the oxide layers containing the radioactive corrosion products and subsequently filter them out using filtration and ion exchange. The NITROX-E/H process has been demonstrated to be effective at dissolving stainless steel oxide films; it was identified as the best process for performing a decontamination of DCPP radioactive piping systems.

NSSS Decontamination Effectiveness

The effectiveness of radiological decontamination is determined by the Decontamination Factor (DF). The DF is simply the ratio of the radiation level before decontamination to the radiation level after the decontamination.

$$DF = \frac{\text{Radiation Level (before decontamination)}}{\text{Radiation Level (after decontamination)}}$$

For DCPP, the effectiveness evaluation was based on the historical source term content and the current source term trends for DCPP. Reviews of the general area dose rates in the DCPP Unit 1 and Unit 2 Containment Buildings indicate that they are cleaner (i.e., less contaminated) than a typical U.S. reactor containment building. General area dose rates range from 4 mrem per hour (mR/h) to 10 mR/h in most of the Containment Building areas. As would be expected, however, there are discrete areas of elevated dose rates.

DFs of 10 to 30 are commonly achieved by chemical decontamination (the range of 10 to 30 DF is a general number derived from various references). The DF may be used to determine the percent of radionuclide removal with the following formula:

$$\text{Percent Activity Removal} = (1\text{-}1/DF) \times 100$$

Using the above formula, a DF of 10 would result in a 90 percent activity removal. A DF of 20 would result in a 95 percent activity removal.

With the current low general area dose for DCPP, high percent activity removals are not required. Any chemical decontamination would need to be in the in the common DF range of 10 to 30. Higher DFs would not provide any appreciable benefit. The optimum DF was assumed to be 20 to balance dose reduction and implementation cost. The study targeted decontamination methods that can achieve a DF higher than 20 to provide margin above the assumed optimum DF.

NSSS Decontamination Cost Estimate

The total costs to perform the recommended chemical decontamination is included in the Decontamination cost shown in Table 4-1. This includes all work and labor to perform the decontamination as well as packaging, transportation, and disposal of additional wastes.

The following issues were considered:

- Total cost, including decontamination vendor costs as well as PG&E costs to support the vendor
- Proper timing of the decontamination
- DF that can be achieved
- Dose reduction benefits from the decontamination
- Dose received by decontamination vendor
- Proven technology versus First-of-a-Kind technology
- Efficiency of performing the actual decontamination steps
- Cost effectiveness versus person-rem evaluation or versus removal
- Primary and secondary wastes produced by the decontamination process
- Risks
- Ease of use

Conclusions/Recommendations

The recommendation to chemically decontaminate the DCPP RCS piping, pressurizer, CVCS, and RHR systems was based on the economics of the evaluation and the need to perform work in the Containment Buildings and in the Auxiliary Building before the first Co-60 half-life period. The current integrated project schedule for DCPP decommissioning demonstrates a clear need to perform both interior Containment Building work and Auxiliary Building work before the first Co-60 half-life decay. Most of this work is related to System and Area Closure (see Section 4.1.1.6), decontamination (see Section 4.1.1.3) and large component removal (see Section 4.1.1.6). The study compared the Alpha Value cost of not performing decontamination with the cost of performing the recommended chemical decontamination. This represents a savings directly related to the health and safety of decommissioning workers. These cost values are included solely to demonstrate the merits of the recommendation to perform contaminated piping system decontamination. Decontamination is recommended to reduce worker exposure during the decommissioning work. It is further recommended to perform chemical decontamination as soon as possible following shutdown to provide the maximum flexibility to adjust other work activities inside the Containment Buildings and in the Auxiliary Building.

4.1.1.4. Reactor Pressure Vessel and Internals Removal and Disposal

RPV and internals removal and disposal consists of all physical and administrative activities necessary to remove the RPVs and internals from the DCPP Containment Buildings. The removal of the RPVs and internals will be accomplished by dismantling the radioactive materials within the Containment Buildings, packaging the segmented waste in various containers designed specifically to meet applicable NRC and DOT regulations, and, depending on waste classification, transporting the loaded packages to either an on-site storage location, or to off-site waste disposal facilities licensed to accept radioactive waste.

The RPV is a component within the RCS, which consists of four loops, connected in parallel to the RPV, each containing a SG, a RCP, and appropriate instrumentation required for both control and protection. The primary function of the RCS is to circulate high pressure water called coolant through the reactor core to remove heat generated by the ongoing nuclear chain reaction. The RPV and its internal support structures are designed to provide a region within the RCS where power production, via the nuclear chain reaction, can occur. The function of the RPV is to contain the fuel and internal support structures; to remain capable of withstanding the effects of high pressures, temperatures, stresses, and radiation that occur during operation; and to serve as a barrier against release of radioactive fission products to the environment.

The RPV is a vertically mounted cylindrical pressure vessel that is 42.3 ft. tall, with a 173-inch internal diameter, and weighs approximately 674,000 pounds. The RPV is constructed with an integral hemispherical head welded to its bottom and a removable hemispherical closure head that is bolted to its top. The closure head is removable to allow access to the internals assemblies for servicing and to allow access to the core for replacing nuclear fuel on a routine frequency. The closure head is discussed within the scope of Large Components, Systems, and Area Dismantling (Section 4.1.1.6.1). The RPV is constructed primarily of welded manganese-molybdenum steel plate and forgings for purposes of corrosion resistance and increased strength and toughness. The internal surfaces of the RPV, which are in contact with the reactor coolant fluid, are clad with stainless steel to reduce corrosion product formation. There are eight coolant nozzles on the RPV, four inlets and four outlets, which connect the RPV to the four parallel loops of the RCS.

Located inside the RPV are two structures, referred to as the lower internals assembly and the upper internals assembly. These structures function to support the core and maintain alignment of the nuclear fuel assemblies, direct coolant flow past the fuel assemblies to remove heat, and to shield the RPV from the effects of gamma and neutron radiation generated during operation.

Figure **4-21** shows an overview of typical Westinghouse designed RPV and internals.

Figure 4-21: Overview of Typical Westinghouse-Designed RPV and Internals

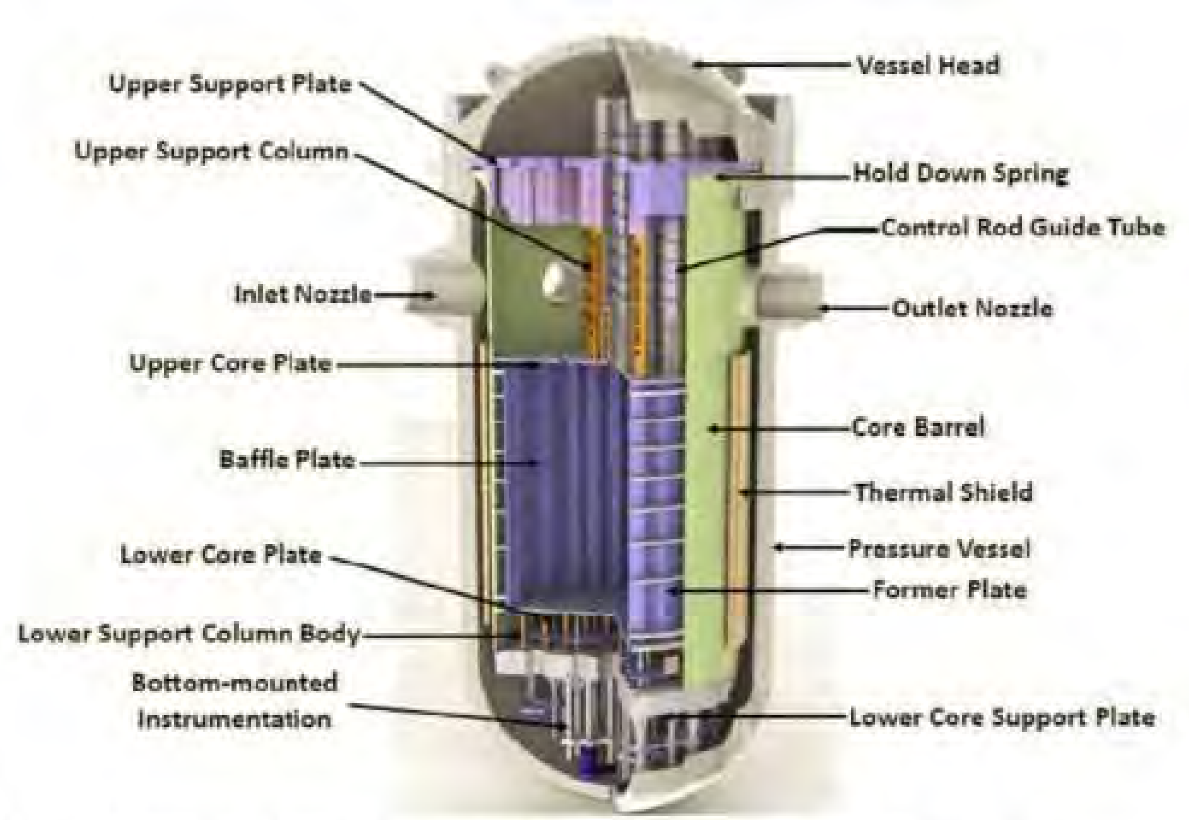


Figure 1 – Overview of Typical Westinghouse-design Reactor Vessel Internals (reproduced from update Westinghouse Figures Presented at Public Meeting on MRP-227, Rev. 1, March 31, 2015, ADAMS Accession No. ML15091A136 Ex. NRC000211)

The lower internals assembly in Unit 1 weighs approximately 325,000 lbs. (270,000 lbs. for Unit 2) and consists of the core barrel, thermal shield (neutron pads in Unit 2), domed lower core support casting (flat lower core support forging in Unit 2), lower core plate and the core baffle assembly. The core barrel is a 30.4-foot long cylindrical shell that hangs from a ledge in the RPV, contains the fuel assemblies, and directs coolant flow through the RPV. The one-piece thermal shield (eight separated neutron pads in Unit 2) is attached to the outer diameter of the core barrel; it functions to attenuate neutrons and gamma radiation to reduce irradiation, embrittlement, and thermally induced stress within the walls of the RPV. The lower core support is welded to the bottom of the core barrel and transfers the weight of the core from the lower core plate to the core barrel. The lower core plate directly supports the fuel and distributes the coolant flow evenly to all fuel assemblies within the core. The core baffle assembly consists of the vertical baffle plates and the horizontal former plates, which together permit transition from the round core barrel to the core's squared periphery. The core baffle assembly also provides lateral restraint of the core to ensure the fuel assemblies remain properly aligned within the reactor.

The upper internals assembly weighs approximately 142,000 pounds and consists of the upper core plate and the upper support assembly, which is comprised of a structurally reinforced support plate, 56 support columns and 61 guide tube assemblies. The upper support assembly functions to provide structural support and restraint of the fuel assemblies, while the support columns transmit loads from the fuel assemblies to the upper support assembly. The guide tube assemblies function to provide unrestricted guidance paths for the control rods that are inserted and removed from the core to provide reactor shutdown and startup capability. The upper core plate is the lowest major component within the upper internals assembly; its purpose is to locate and align the fuel assemblies with the guide tubes to ensure that control rods can be inserted into the core.

To support planning and scheduling of RPV and internals segmentation activities, a waste characterization analysis was performed to develop a basis for the radionuclide isotopes and concentrations that will be present within the RPVs and internals at the time of final shutdown for Units 1 and 2. Effective Full Power Years (EFPY) provides a measure for the duration of time the reactor is operated at full power and is a key input to the analysis that estimates the radionuclide concentrations that will be present at time of final shutdown within the base materials of the RPVs and internals. The analysis time frame is typically derived from actual cycle operating histories of the reactors. In this case, however, final plant exposure has not been determined as the DCPP Unit 1 and Unit 2 reactors will continue to operate until the end of their respective licenses. Past and planned operating conditions provide an overall ceiling of 35 EFPY of exposure for both units, so a bounding operational time frame of 35 EFPY was used for the waste characterization analysis.

The composition of the materials used to build the RPVs and internals can have a significant impact on characterization analysis results, so Certified Material Test Report (CMTR) data from the materials used to construct DCPP Unit 1 and Unit 2 RPVs and internals was used for the waste characterization analysis. The CMTRs provide base elemental concentrations for the constituent materials that comprise the final steel alloys that were used to build the RPVs and internals. In addition to base elemental concentrations, the CMTRs include trace element concentrations that do not affect material performance but are important to waste characterization. Not all CMTRs reported all relevant element concentrations for all RPV and internals materials; in these cases, elemental concentrations for long-lived radionuclides were obtained from NUREG-3474 (Reference 4.7) to supplement the missing data.

The estimated radioactivity quantities for the RPVs and internals determined from the waste characterization analysis were decay-corrected to five approximate time scenarios: cessation of operation (zero years), two years following cessation of operation, five years following cessation of operation, seven years following cessation of operation and ten years following cessation of operation. Due to close proximity to the nuclear fuel, the RPV and internals become highly radioactive, and the radionuclide concentrations estimated to be present after 35 EFPY result in extremely high levels of radiation emanating from the materials.

The waste characterization analysis determined that the optimal time to begin RPV and internals segmentation and packaging is approximately 5.3 years after shutdown. This allows time for adequate radioactive decay of short-lived gamma-emitting radionuclides, which will reduce accumulation of worker dose; allow for immediate transportation of waste to licensed off-site waste disposal facilities; optimize reactor internals segmentation duration by allowing for larger individual pieces; and support timely reduction in security requirements for areas beyond the ISFSI pad, as described in Section 3.4.4.3, by ensuring the reactor internals waste classified as GTCC is removed from the Containment Buildings and placed for storage on the ISFSI pad no later than seven years after Unit 2 is shut down. The waste characterization analysis also concluded that additional delay in starting segmentation beyond 5.3 years after shutdown would not result in appreciable further radioactive decay of long-lived gamma-emitting radionuclides until more than 20 years after shutdown, which is beyond the planned time for decommissioning.

Results of the waste characterization analysis were used to develop unit specific segmentation and packaging plans for the RPVs and internals that meet NRC and DOT regulation limits for transporting and disposing of radioactive waste. The cost to dispose of Class A waste is significantly less than Class B or Class C waste. Given this, efforts were made during development of the segmentation plan to maximize the quantity of Class A waste. In addition, efforts were made to minimize the total number of packages required for disposal and to minimize the quantity of GTCC waste due to the unknown costs for future disposal of GTCC waste.

The segmentation and packaging plans were developed through an iterative process of evaluating input parameters and results to ensure schedule, cost and ALARA efficiencies are maximized during implementation of both plans. The segmentation plan required input from both the waste characterization analysis and the package plan to develop the strategy for cut locations and sizes of resulting segments of the RPVs and internals components. The segmentation plan required evaluation of numerous parameters, including size, weight, material type, accessibility and expected dose rates of the components to be segmented; limitations associated with the physical work location; restrictions on tooling technologies when underwater shielding is required; and the size, capacity, and dose rate limitations of the various containers to be used for packaging and transporting the waste.

The package plan required input from both the waste characterization analysis and the segmentation plan to develop the strategy for packaging the liberated segments of the RPVs and internals. Limited types of are packages available that can store and transport waste with the radionuclide concentrations that will be present in the RPVs and internals at the start of segmentation. The containers selected for the package plan primarily consist of large capacity liners, which fulfills the goal of minimizing the number of packages required for on-site storage and shipment. However, to optimize the package plan and associated costs for transport to and disposal at off-site waste disposal facilities, additional special design containers will be used as appropriate to account for the variations in size and activity content in different segments and the anticipated transport modes.

Based on results of the waste characterization analysis and the segmentation and packaging plans, Table 4-8 and Table 4-9 provide a summary of the projected number of Unit 1 and Unit 2 RPV and internals waste packages for each of the 10 CFR 61.55 waste classifications and the associated net weight and burial volume of RPV and internals waste for each waste classification.

Table 4-8: DCPP Waste Volume Totals by NRC Waste Class for Unit 1 RPV and Internals

NRC Waste Class	Number of Packages	Waste Weight (lbs.)	Burial Volume (ft^3)
A	[redacted]	881,240	[redacted]
B		94,398	
C		61,257	
GTCC	4	49,680	
Total	[redacted]	1,086,575	

Table 4-9: DCPP Waste Volume Totals by NRC Waste Class for Unit 2 RPV and Internals

NRC Waste Class	Number of Packages	Waste Weight (lbs.)	Burial Volume (ft^3)
A	[redacted]	528,641	[redacted]
B		318,069	
C		148,137	
GTCC	4	50,298	
Total	[redacted]	1,045,145	

As a result of the waste characterization study, the lower core plate, baffle plates, baffle former plates, and portions of the lower core support columns from both Unit 1 and Unit 2 were classified as GTCC waste. To help develop the segmentation and packaging strategy, a waste packaging system similar to the Holtec-designed dry fuel storage system currently used at DCPP was assumed for packaging, handling, and storage of GTCC waste materials. The Holtec equipment owned by PG&E is expected to be compatible with the GTCC packaging and storage system, resulting in financial savings. Section 4.1.1.5.1 provides additional bases for the assumption to use Holtec waste storage systems.

RPV and internals segmentation have typically been performed long after reactor shutdown, allowing for substantial radioactive decay to occur. In addition, poor operational performance at many of these reactors resulted in considerably less total EFPY than DCPP Unit 1 and Unit 2. Put another way, total radionuclide concentrations at DCPP will be significantly higher than those that have been encountered during decommissioning at other plants. To address this, the PG&E plan for RPV and internals segmentation was developed in a way that minimizes the health, safety, schedule, and cost risks posed by the radionuclide concentrations.

Due to the extremely high radionuclide concentrations that will be present in the GTCC waste, storage of the GTCC waste on the DC ISFSI pad may challenge the on-site dose rate limits specified by 10 CFR 20.1201 and 20.1301 (Reference 4.8), as well as the off-site dose rate limits specified by 10 CFR 72.104 and 72.106 (Reference 4.9) for the first 10 years of storage due to the expected high gamma dose rates emanating from these storage containers. To protect the reliability of the decommissioning schedule and cost estimate, which could be adversely impacted should reactor internals segmentation work have to be halted because the GTCC containers cannot be placed on the ISFSI pad, the cost estimate accounts for a total of four waste containers per unit for storing the GTCC waste from the reactor internals. Although the volumes of GTCC waste from the reactor internals can physically fit within two waste containers per unit, increasing the number of containers per unit from two to four will decrease the total radioactivity concentrations within each container and will significantly increase the remaining space in each container. That in turn will allow for the installation of more robust internal shielding, which will help reduce general area dose rates surrounding the storage containers to levels that conform with applicable 10 CFR Part 20 and 10 CFR Part 72 requirements.

Segmentation Preliminary Activities

The scope of segmentation preliminary activities includes design, fabrication and testing of tooling and equipment that will be used to implement the unit specific segmentation and packaging plans. It also includes the necessary training to ensure that individuals performing work have been authorized site access and are adequately qualified to perform segmentation activities in a safe, timely and cost-efficient manner. Preliminary activities also include mobilization of crews and equipment to the site, along with development and approval of all programmatic plans and work packages that will govern performance of work. Last, preliminary activities include the performance of activation analysis validation surveys and evaluation of any warranted changes to the segmentation and packaging plans.

Segmentation of highly activated RPV and internals is one of the most challenging tasks to perform during a decommissioning project due to the radiological and industrial hazards faced by workers. The high levels of radiation coming from the RPV and internals requires the use of specially designed equipment for all aspects of the project, including segmenting, handling, packaging, and shipment of these materials to licensed waste disposal facilities. Although segmentation of the RPV poses numerous and unique challenges due to overall size and accessibility, the internals components pose significantly greater challenges since the internals structures consist of components with complex and unique geometries that were assembled in a way to ensure durability and resistance to deterioration. The large amounts of radiation emitted by the activated materials within the internals structures will require these components to be segmented under water to minimize accumulated dose to the workers. Segmentation of the RPV and internals is expected to be a critical path activity, and difficulties encountered during this part of the project could cause significant schedule delays and cost overruns. As such, significant effort is required to design, fabricate, and test the tooling equipment to minimize schedule delays and cost overruns associated with tooling during on-site segmentation activities.

Tooling Evaluation, Design, Fabrication, and Acceptance Testing

Industry experts with previous RPV and internals segmentation experience evaluated multiple segmentation tooling technologies. They drew from operating experience and lessons learned from previous nuclear plant RPV and internals segmentation projects including Shippingport in Pennsylvania, Yankee Rowe in Massachusetts, Big Rock Point in Michigan, Trojan in Oregon, Connecticut Yankee in Connecticut, Maine Yankee in Maine, and SONGS Unit 1 and HBPP in California. The purpose of this evaluation was to determine recommended tooling technologies to be used for RPV and internals segmentation during DCPP decommissioning activities. The evaluation was performed by comparing the relative strengths and weaknesses of multiple tooling technologies to the attributes necessary to ensure safe, timely and successful segmentation of the RPVs and internals.

The evaluation resulted in the following recommendation for tooling technologies to be used for segmentation of the RPV and internals at DCPP:

- Mechanical cutting processes will be used for reactor internals segmentation
- Thermal cutting process will be used for RPV segmentation

It is noted that the evaluation resulted in the recommendation to use the same technologies as those that were successfully used for the most recent segmentation of Zion Nuclear Station Units 1 and 2 in Illinois and that are planned to be used for segmentation of the SONGS Units 2 and 3 RPV and internals.

Whole disposal of the RPVs was evaluated and determined to not be feasible based upon the following:

- The Unit 1 and Unit 2 RPVs are both estimated to achieve 35 EFPY of cumulative exposure, so the projected total curie content of the whole RPVs will result in the unlikely ability to design and license a shipping container that meets the requirements of 10 CFR 71.41(d) because the required size of the transportation cask being too large to ship

- Transportation challenges, including: insufficient rail clearances based on the anticipated weight and dimensions of a compliant package if one could be developed; rail company requirements for 100 percent indemnification of revenue affected by any transportation incident for a load of this size and weight; negative public relations and potential for legal action to stop transport through federal, state, and local jurisdictions along the transport route.

Extensive engineering is required to design the tooling and equipment that will be used to segment the RPVs and internals. Due to the size, durability, and limitations on access to the RPVs and internals resulting from expected dose rates, the design process considers these and other inputs to ensure that all standard code and safety requirements are met. It also considers that the tooling and equipment minimizes delays to the schedule by being highly reliable, maximizes ease of control for operators, provides ability for remote and underwater installation and operation, minimizes and controls secondary waste generated during the segmentation process, and includes features necessary to ensure that personnel safety is maintained at all times. An integral component of tooling design is a review and incorporation of industry operating experience. To capture positive industry experience and to ensure past challenges are addressed during design development, a review of available industry segmentation project experience reports will be performed. By incorporating lessons learned into the design of tooling and equipment, unexpected problems will be addressed and resolved via engineered solutions before the tooling and associated equipment is used.

Once final design documentation and drawings are approved and issued, a specialty fabricator with experience and expertise in building sophisticated machining and cutting systems will manufacture the tooling and equipment specified by the design. Since the tooling and equipment will become contaminated with radioactive materials upon initial use, and since tooling used for segmentation of internals components will be mostly inaccessible under water, the chosen fabricator must have extensive experience and a successful track record to eliminate schedule and cost overruns that would arise due to unexpected tooling and equipment degradation or failure once production has begun.

To further protect against segmentation tooling and equipment degradation or failure, each piece of equipment designed and fabricated will be thoroughly factory acceptance tested in accordance with a specified test procedure using mock-ups (i.e., full-scale models) of portions of the RPV and internals, procedures, and conditions that accurately represent the conditions that will be encountered during the actual project's execution. For tooling that will be used underwater, experience indicates factory acceptance testing is better performed dry, which allows for inspection during the cutting process by the tool engineer and results in more demanding conditions than those experienced underwater. Segmentation tooling acceptance testing experience in previous RPV and internals segmentation campaigns has confirmed that cutting production and performance will improve once the equipment and tooling is placed in service in an underwater environment. Performance of factory acceptance testing on representative mock-ups will ensure that the designed and fabricated equipment is robust and capable of performing the required design function at design production rates. Individual equipment tests will be followed by integrated systems tests. Test durations will be representative of expected service durations to ensure durability and to eliminate the potential for defects and failures that would be expected to become evident during the initial period of equipment operation. Tests will be repeated as needed to ensure that the results are consistent and reproducible. Each piece of equipment will be evaluated in accordance with parameters such as ease of tool removal and reinstallation, tool rigidity, precision and repeatability of tool placement and control, ease of securing and fastening of equipment, consistency and repeatability of operations, camera placement, controls and operation, and ease of routine maintenance such as replacement of consumable parts. Factory acceptance testing will demonstrate that the equipment provides reliable techniques to complete the segmentation activities while minimizing personnel radiation exposure and generation of large volumes of secondary radioactive waste. Any required changes in design that are identified during acceptance testing will be incorporated before the equipment and anticipated spare equipment is delivered to the site.

Performing factory acceptance testing not only offers the benefit of evaluating equipment functionality, capability, and reliability, it gives equipment operators training on efficient ways to set up, operate, and maintain the equipment before using it in areas with high radiation dose rates.

Project Management

The contractor's project management function and associated organization will establish and direct all project management and level of effort activities that are required for support of the RPV and internals removal and disposal project. The contractor's project organization will be led by a Project Director who has authority on behalf of the contractor for commercial matters and resources required to ensure successful delivery of the project scope. Reporting to the project director will be a staff responsible for managing the performance of contractor personnel in the areas of Engineering, Environmental Safety & Health, Quality, Operations, Waste Handling & Disposal, and Business Services.

Prior to and after being mobilized to site, the segmentation team will develop a detailed dismantling and removal schedule sequence, detailed work packages to support execution of work, engineering and rigging lift plans for activities involving movement and handling of heavy loads, and engineering design documents to support needed facility modifications.

To minimize the total schedule duration for Units 1 and 2 RPV and internals segmentation activities, segmentation of the Unit 2 RPV and internals will be performed concurrent with completion of the Unit 1 RPV and internals segmentation activities. The start of activities associated with Unit 2 are labor resource dependent following a period of operating experience obtained from segmentation operations within Unit 1. This results in an offset of approximately seven months between the start of segmentation operations between Units 1 and 2. To support parallel segmentation activities for both Units 1 and 2, two complete sets of RPV and internals segmentation equipment will be provided. The total duration for both units, with Unit 2 work in parallel commencing seven months after Unit 1 start is approximately 56 months.

Waste Characterization Analysis Validation

Before beginning segmentation, a validation of the activation analysis results and associated segmentation and packaging plans will be performed. Performance of the validation survey involves obtaining underwater radiation surveys of the RPV and lower and upper internals components at specified distances and locations. The validation dose rates obtained from the survey will be compared to the radionuclide concentrations estimated by the waste characterization analysis to determine if any changes to the segmentation or packaging plans are needed to maintain alignment with applicable DOT and NRC requirements. Before implementing the segmentation plan, the measured dose rates will be used in conjunction with three-dimensional models of the RPV and internals components to adjust estimated radionuclide concentrations to the concentrations corresponding to the obtained dose measurements. Validation surveys are prudent and typical for this process but rarely result in significant changes to the segmentation or package plans or to the overall waste classification and associated net volume estimates.

Internals Segmentation and Packaging

The scope of internals segmentation and packaging includes all resources and physical activities required to prepare the Containment Buildings, the refueling cavities, and the RPVs for segmentation of the internals, along with actual segmentation and packaging of the internals components into waste containers and liners specified by the packaging plan, based on results of the waste classification. Once the loaded containers and liners are ready for shipment, they will be loaded into applicable licensed transportation casks designed specifically to meet the requirements of 49 CFR Part 173.

As discussed in Section 3.4.4.3, removal of the material classified as GTCC waste in both units within seven years after Unit 2 shutdown will enable the security footprint at the site to be reduced, resulting in considerable reduction of operating expenses. With this constraint in mind, the sequence of work required to liberate and transport the GTCC material to the ISFSI pad has been used to anchor the start of the actual on-site operations for the reactor internals segmentation and packaging for Unit 1. The start of activities associated with Unit 2 are labor resource dependent following a period of operating experience obtained from operations within Unit 1. This results in an offset of approximately seven months between the start of segmentation operations between the units and ensures that the GTCC materials from both units will be placed on the ISFSI pad no later than seven years after Unit 2 is shut down. Two complete sets of reactor internals segmentation tooling and equipment will be provided to support parallel segmentation activities in Units 1 and 2.

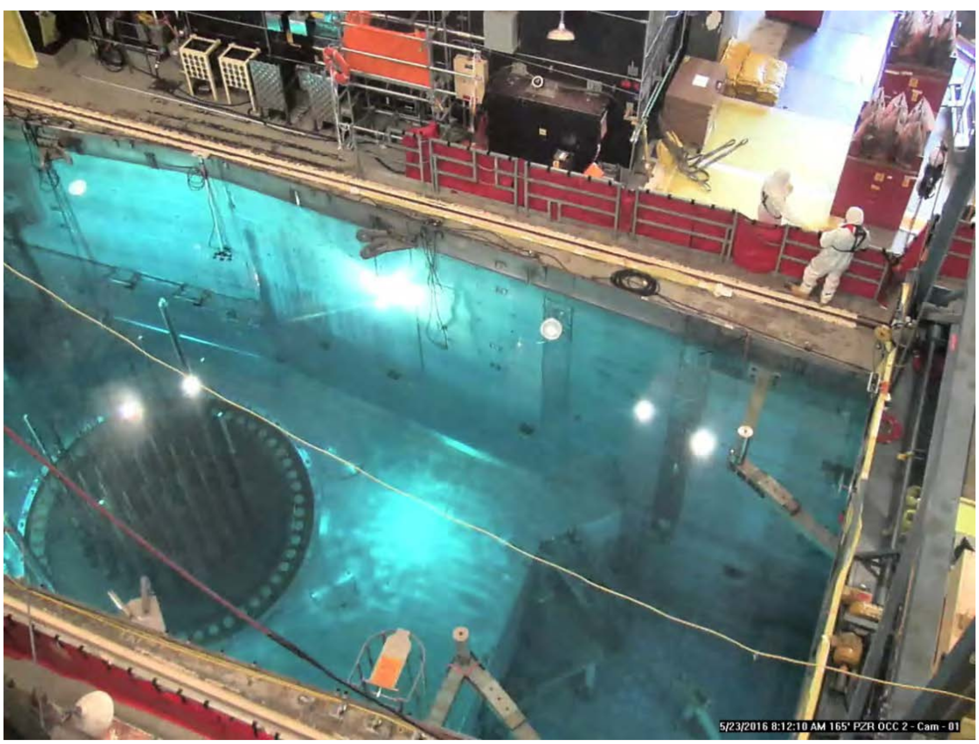
Internals Preliminary Activities

Before starting mechanical segmentation, on-site preparatory activities are required, including modifications to the Containment Buildings, refueling cavities, and RPVs. The major activity required to prepare each Containment Building is to enlarge the existing equipment hatch construction opening to allow the safe and efficient movement of heavy loads across the containment refueling floor to the adjacent elevation outside containment. The major activities required to prepare each refueling cavity consist of removing and replacing the installed upper internals storage stand with a specially designed rotary table, and installation of a leak tight seal ring to secure the gap between the RPV and the refueling cavity. Activities required to prepare each RPV consist of severing the eight sections of main coolant loop piping from the inlet and outlet nozzles of the RPV and sealing the open penetrations to ensure that the RPV remains leak tight during the period when the refueling cavity will remain flooded in support of internals segmentation. In addition, the 58 instrument penetrations located on the lower head of the RPV will be severed and sealed to allow complete isolation of the RPV and flooded volume of the refueling cavity from other equipment within the RCS.

The existing Containment Building equipment hatch is an approximately 18-ft. diameter opening that is located approximately 24 inches above the refueling floor elevation. The hatch is used to load equipment in and out of containment to support routine maintenance activities that are performed during refueling outages. The size and elevation above the refueling floor make the existing configuration inadequate to support movement of equipment, tooling, and waste containers in and out of each Containment Building during decommissioning. Modification to the existing equipment hatch is required to support segmentation activities and will be performed before starting segmentation to support removal of select large components from the Containment Building. Modification of this construction opening is discussed within the scope of Large Components, Systems, and Area Dismantling (Section 4.1.1.6.1).

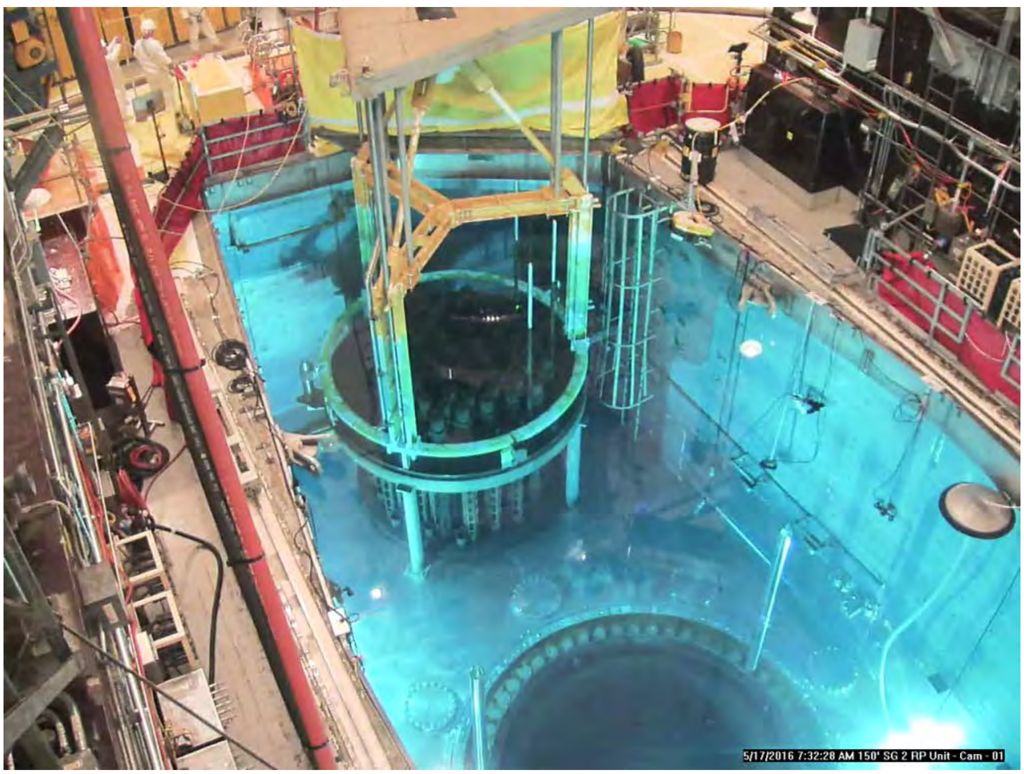
Since segmentation of the upper and lower internals structures will be performed outside of the RPVs, staging and work space within the refueling cavities will be limited. Segmentation of the lower internals will be performed in the east (deep) end of each refueling cavity, with the lower internals structure placed on the existing lower internals storage stand located in the deep end of the refueling cavity. The existing lower internals storage stand and its proximity to the reactor vessel are shown in Figure 4-22.

Figure 4-22: Deep End of Refueling Cavity with Upper Internals in Reactor Vessel



Segmentation of the upper internals will be performed in the west (shallow) end of each refueling cavity where the existing upper internals storage stand is installed. To accommodate segmenting the upper internals, a specially designed platform and rotary table, referred to as the Primary Segmentation Station (PSS), capable of supporting and maneuvering the upper internals structure, will be installed in the same location as the existing upper internals storage stand after the original storage stand has been removed. Removal of the existing storage stand, and installation of the specially designed platform and segmentation equipment, will be performed before flooding the refueling cavity. The existing upper internals storage stand and its proximity to the reactor vessel are shown in Figure 4-23.

Figure 4-23: Refueling Cavity Shallow End with Upper Internals in Storage Stand



To expand the floor space available within each refueling cavity, a reactor cover plate will be installed over the opening of the RPV. This cover plate will be used as additional staging space for waste liners and containers that the segmented pieces of the internals will be loaded into. Last, before flooding the refueling cavity, a permanent seal ring designed specifically to prevent leakage between the RPV and the refueling cavity will be installed to ensure the water volume that is attenuating radiation dose to personnel is maintained, and to prevent the escape of any radioactive particles liberated during segmentation to areas outside the refueling cavity.

After all containment modifications, refueling cavity modifications, installation of the permanent cavity seal, isolation of the RPV, and installation of all required tooling, equipment and water processing equipment are completed, the refueling cavity will be flooded with clean, non-borated water to allow the internals structures to be removed from the RPV to begin final equipment testing and segmentation activities. Based on industry lessons learned, which emphasize the importance of a water filtration system during performance of segmentation activities, the water in the refueling cavity will be sampled daily to track the level of radiological contamination, and an underwater filtration system with an ion exchange bed will be used to maintain water quality, clarity, and a low radionuclide concentration level.

Internals Segmentation

With the shallow and deep end segmentation work locations now available, segmentation will begin with removal of the GTCC classified baffle plates and baffle former plates using a milling process to remove the bolts that secure these plates to the core barrel. The baffle plates and baffle former plates will be directly loaded into staged GTCC baskets located in the deep end near the fuel transfer canal. While in the shallow end of the cavity, the PSS will be used to volume reduce the upper internals. Segments from the upper internals will be loaded either into shielded boxes positioned on the operating floor within containment or intermediate height liners positioned on the reactor cover within the cavity.

After removal of the baffle assemblies and upper internals, a tool referred to as the Internal Barrel Cutter (IBC) will be inserted into the lower internals to liberate sections of the core barrel and thermal shields. The IBC is designed to sever cylindrical components such as the core barrel and thermal shield while deployed from the inside of the cylinder. A fixed platform uses internally developed radial pressure to push outward against the wall of the cylinder with sufficient force to fix the platform at the selected elevation to perform the cut. When fixed in position, a moving table freely rotates about rails and gears on the fixed base. The table includes a moving sled that when plunged forward delivers the cutter through the cylinder and can cut wall thickness up to 11.5 inches. The cuts are completed using a series of plunging cuts about its axis from a remote operating station in a low dose area. The liberated section at the end of each cut is delivered for volume reduction underwater using the PSS.

These sections will be transferred to the PSS to perform vertical volume reduction cuts prescribed by the segmentation plan. These segments will be loaded to intermediate height liners positioned on the reactor cover within the refueling cavity. It is important to recognize that these sequences will deviate between the two units as Unit 1 is fitted with a concentric thermal shield and Unit 2 is equipped with four neutron panels.

With the thermal shields and core barrel cylinders removed, long-handled extensions will be deployed from the segmentation bridge to remove the fasteners securing the lower core plate to the core barrel, in-core instrument nozzles and support columns. Once completely liberated, the lower core plate will be moved to the PSS for volume reduction. The lower core plate segments will be loaded directly into the staged GTCC baskets located in the deep end of the refueling cavity.

Reactor internals segmentation of Unit 2 will begin before completing the same activities in Unit 1. Once the final sections of the Unit 1 lower support assembly are handed off to the PSS crew for final segmentation in the shallow end of the refueling cavity, workers performing internals segmentation activities in the deep end of the refueling cavity will transfer to the Unit 2 Containment Building and begin installing the second set of internals segmentation tooling and equipment. In addition, these workers will perform the same preliminary activities that were previously described for Unit 1. Following installation and testing of the Unit 2 internals segmentation tooling and equipment, and implementation of necessary preliminary activities, segmentation of the Unit 2 reactor internals will begin and be performed concurrent with completion of the Unit 1 reactor internals segmentation activities.

After the lower core plate is removed and packaged, the remaining lower assembly will be lifted and positioned upon the PSS. The remaining remnants of the thermal shield and core barrel will also be further segmented after being positioned upon the PSS. The support columns and flow distributer plate (Unit 1 only) will be removed using horizontal saws deployed from the PSS crossbeam. Being GTCC, the support columns will be loaded into the staged GTCC baskets located in the deep end of the refueling cavity, completing the packaging of GTCC waste items. At this point, a Holtec HI-TRAC shielded transfer container that has been previously loaded with a Holtec Non-Fuel Waste Container (NFWC) will be positioned in the deep end of the refueling cavity allowing for the GTCC baskets to be placed into the HI-TRAC to help remove the GTCC waste from Containment.

To complete the processing of the remaining lower internals, the remaining assembly will be inverted using expert rigging services, and long-handled extensions will be used to remove the fasteners securing the lower support posts and support columns. These items will be packaged within intermediate height liners positioned on the reactor cover within the cavity. Then the remaining lower core forging will be further segmented on the PSS and the produced segments from the forging will be packaged within intermediate height liners positioned on the reactor cover within the refueling cavity.

<u>Internals Packaging</u>

Concurrent with the segmentation activities, waste materials will be produced and packaged in accordance with the prepared packaging plan. Packages will be produced using a combination of customized shielded Type A waste containers and intermediate height liners configured for storage and transportation in the Holtec HI-SAFE and HI-STAR Systems.

Customized shielded Type A containers will be used for packaging some of the lowest level activated items characterized as Class A with limited dose rate characteristics. These include items from the upper core barrel, upper control rod guide tubes and deep beam weldment. A special box will be used to load the control rod drive shafts during the preliminary activities.

The intermediate height liners are designed to fit within the NFWCs compatible with the designated Holtec HI-STAR transport cask. Due to geometrical constraints within the refueling cavity, and to ensure that adequate shielding is provided by the maintained water level, each NFWC will be loaded with two intermediate liners. These liners will be loaded underwater, lifted into a transfer bell, and transferred to the Fuel Handling Building. The transfer bell will be lifted by the Fuel Handling Building crane and positioned above the NFWC that has been fit within the HI-STAR transport cask. The transfer bell will return to containment for the second liner; once it is loaded into the transport cask the package will be transported for disposal. For temporary interim storage, it is anticipated that the Unit 1 SFP will be available to store intermediate liners as a backlog develops in transporting them to the disposal facility and possible delays associated with activity limits occur at the disposal facility.

For purposes of this cost estimate, PG&E assumed that a Holtec cask design will be used to store the GTCC waste within the existing DCPP ISFSI footprint. Section 4.1.1.5.1 specifies the basis for this assumption.

Once the segmented portions of GTCC waste have been placed into designated underwater waste containers, a high-density lid will be placed on each GTCC container and they will be loaded into the Holtec HI-TRAC shielded transfer cask. The transfer cask will then be lifted from the flooded refueling cavity, using the containment polar crane, and placed on a SPMT within the Containment Building. After the load is secured to the SPMT, it will be transferred out of containment through the expanded equipment hatch construction opening. Once outside Containment, the load will be moved to the Fuel Handling Building where it will be lifted with the fuel handling building crane and moved to the Unit 2 cask washdown pit and secured in the currently installed seismic restraint device located near the Unit 2 SFP. Once secured within the seismic restraint device, the loaded GTCC containers will be processed and delivered to the ISFSI pad by spent fuel transfer operations personnel as detailed in Section 4.1.2.3.1.

Remaining Class A, B and C waste will be loaded into waste liners and containers specified by the packaging plan. After liners and containers are loaded with waste in the refueling cavity, a specially designed shield bell will be placed over the liner or container, and the entire load will be lifted using the polar crane, then placed on the SPMT and transported to the Unit 1 SFP for storage until the containers are scheduled for shipment to the specified waste disposal facility.

Internals Segmentation Concluding Activities

Industry lessons learned emphasize the importance of a water filtration system when water is transferred after internals segmentation activities are completed. Based on this, a thorough vacuuming and clean-up of any remnant cutting debris will be performed after internals segmentation activities are completed and before the refueling cavity is drained to prepare for RPV segmentation. Ongoing refueling cavity sampling and filtration during reactor internals segmentation activities will ensure that the refueling cavity water will be suitable for draining to the temporary liquid radioactive waste holding tank following completion of reactor internals segmentation activities. To ensure that fine radioactive particulate is not transferred from the refueling cavity during draining, the liquid transfer pump will be outfitted with cartridge filters specifically for the collection of smaller debris. In addition, as refueling cavity water is being drained, the refueling cavity walls will be pressure washed and decontaminated as the water level decreases.

After the refueling cavity is fully drained, the floor will be decontaminated and surveyed, leading to the removal of all equipment dedicated exclusively to internals segmentation operations, including the primary cutting system and all miscellaneous support equipment (containers, rigging, hand tools) not needed to support RPV segmentation activities. All contaminated materials will be packaged for disposal, and non-contaminated equipment, materials and supplies will be surveyed for release and removed from site as part of demobilization activities.

Pressure Vessel Segmentation and Packaging

After reactor internals segmentation activities are completed in each unit, segmentation of the RPV will immediately follow. Equipment design, fabrication and testing of the RPV segmentation tooling will follow the same activities that were performed for the reactor internals segmentation tooling and equipment during the preparatory period. Like the reactor internals segmentation operations, RPV segmentation operations will be performed concurrently in Unit 1 and Unit 2, so two complete segmentation tooling systems will be used. The scope of RPV segmentation and packaging includes all resources and physical activities required to prepare each refueling cavity and RPV for segmentation, along with actual segmentation and packaging of the RPV into waste containers and liners specified by the packaging plan, based on results of the waste classification. Once the loaded containers and liners are ready for shipment, they will be loaded into applicable licensed transportation casks designed specifically to meet the requirements of 49 CFR 173.

Preliminary activities, including the engineered controls and systems required to perform the RPV segmentation, are substantial and require approximately three months for installation and functional testing. Once RPV segmentation tooling is commissioned, each RPV is expected to be segmented and packaged in approximately five months.

Pressure Vessel Preliminary Activities

The thermal cutting technology to be employed for RPV segmentation uses the area below the floor elevation of the refueling cavity that is directly adjacent to the outer circumference of the RPV. This area, referred to as the nozzle gallery, provides a worker access and inspection walkway surrounding the RPV at the elevation where the RPV inlet and outlet nozzles connect to the eight sections of RCS main coolant loop piping. The nozzle gallery is where the dynamic flame cutting work is performed due to the natural containment and shielding properties of the circular concrete wall that surrounds the RPV below the refueling cavity. The cylindrical concrete wall surrounding the RPV below the refueling cavity is referred to as the bio-shield. To obtain full benefit of the bio-shield, some facility modifications will be required to this area before beginning RPV segmentation activities.

Initially, the RPV will be filled with clean water to an elevation just below the inlet and outlet nozzles. A lifting fixture will be installed into the RPV. It will include a center support rod that also serves as the main ventilation port for removing gases from the RPV during cutting activities; six lifting arms perpendicular to the bottom of the support rod and positioned at 60° intervals; and removable metal pans spanning the space between each of the lifting arms to capture the waste slag generated from thermal cutting operations. Once installed into the RPV, the lifting fixture will be rotated into the final position; the lifting arms will be positioned directly beneath each of the six reactor internals' anti-rotation lugs attached to the inner wall of the RPV near the elevation where the vertical shell of the RPV transitions to the bottom hemispherical head. As the lifting fixture is raised, it will engage the RPV from beneath the reactor internals anti-rotation lugs. When the lifting fixture is engaged, the RPV will be capable of being lifted to the required cutting elevations. After the lifting fixture is installed, a two-piece shielding plate will be installed atop the RPV so that the remaining water within the vessel can be removed while providing acceptable general area dose rate directly above the RPV.

An enclosure will be erected within the refueling cavity above the nozzle gallery area and ventilated to a negative pressure relative to the containment general area using portable HEPA filtration units. Concrete breakers and common demolition tools will be used to clear the structures, systems and components forming the nozzle gallery room. Concurrently, personnel will enter the enclosed area of the Containment Building located directly below the RPV to access and remove the mirror insulation covering the lower hemispherical head of the RPV. The in-core instrumentation nozzles will be severed as close as practical to the outside surface of the RPV. The associated conduits to these nozzles and the access platform below the vessel will be removed to clear this area for the mirror insulation removal that surrounds the beltline of the RPV.

With the RPV main coolant loop nozzles exposed, diamond wire saws will be deployed within the enclosed nozzle gallery to remove the exposed RCS piping. The thermal cutting system is not able to breach the areas of the RPV in which stainless steel cladding has been built up on horizontal surfaces. For this reason, wire saws will be used to score the cut lines deep enough to remove the problematic areas of cladding (occurs only in the nozzle region). Once diamond wire cutting is completed, the negative air enclosure can be removed and disposed.

The thermal cutting system to be employed depends on the ability to lift the RPV. The existing polar crane will not be available to lift the RPV since it is required for other activities, including handling of waste containers, and lifting and moving segmented portions of the RPV as they are liberated. As a result, a strand jack system connected to the lifting fixture will be used to lift and secure the RPV at the elevations required to execute the segmentation plan. The system includes four independent jacks installed atop a beam mounted bridge (designed specifically to support RPV segmentation activities), which is installed atop the refueling cavity walls directly above the RPV. Concurrently with these components, the off-gas ventilation and filtration systems (Torit pre-filter and HEPAs) will be installed and commissioned, with the off gas being directed to the main containment ventilation intake.

The strand jack system will carry the load of the RPV, allowing for the removal of the RPV support blocks that are installed below four of the RPV nozzles. Removal of the support blocks allows for the installation of the turnable shield plate assembly. This assembly allows for the in-situ segmentation of the RPV and serves to shield personnel from radiation; carry the flame cutting system and rotate it into working position, working as a suction hood to avoid spreading airborne contamination into the Containment Building; and to serve as a working platform to prepare tools for cutting processes.

Pressure Vessel Segmentation Activities

The segmentation of the RPV will be performed in five vertical vessel movements. With the vessel lifted into position within the turnable shield plate assembly, the flame cutting system will be used to cut segments from the outside to within the RPV. Slag and debris will be blasted to the inside of the RPV and collected in the dross pans supported by the lifting rod. Fumes containing airborne particles will be passed thru HEPA filtration before being discharged to the primary air intake plenum.

In each vertical movement, most of the cutting will be performed without removing any resulting segments. The polar crane will be fitted with a remote grapple to secure the removed segment as the last remaining portion of each cut is completed. The resulting segments will be either loaded into staged custom shielded boxes or Holtec NFWCs shielded within the HI-TRAC transfer cask.

Pressure Vessel Packaging Activities

Concurrent with the pressure vessel segmentation activities, the liberated segments of the RPV will be packaged in accordance with the prepared packaging plan. Packages will be produced using customized shielded Type A boxes and NFWCs configured for transportation in the designated Holtec HI-STAR transport cask.

Customized shielded Type A boxes will be used for packaging the lower activated portions of the RPVs presenting limited dose rate characteristics. These include segments from the flange, nozzle, and bottom head regions of the RPV. The NFWCs compatible with the Holtec HI-STAR transport cask will be used to package the beltline region of the RPVs.

Pressure Vessel Concluding Activities

After RPV segmentation activities are completed, the contractor will remove all equipment used during cutting operations, including the primary cutting system and any cutting debris; enclosure system and associated ventilation/filtration equipment; and all miscellaneous support equipment (containers, rigging, hand tools). All contaminated materials will be packaged for disposal, and non-contaminated equipment, materials and supplies will be surveyed for release and removed from site as part of demobilization activities.

Pressure Vessel Insulation Removal and Packaging

Preparatory activities associated with this work include removing the insulation from the hemispherical bottom head of the RPV and the insulation above the centerline of the hot and cold leg nozzles. The RPV wall insulation is supported from the insulation components surrounding the hot and cold leg nozzles. Once the insulation components surrounding the hot and cold leg nozzles have been removed, the portions of the RPV wall insulation within the bio-shield that were not previously removed will be lowered to the area below the RPV.

A fabricated ring will be installed about the interior opening of the bio-shield within the nozzle gallery region. An array of lead blankets will be hung, creating a shielded perimeter about the bio-shield opening. Rigging will be attached to the remaining insulation, and the insulation will be lifted to an elevation that exposes the first encountered horizontal seam. Temporary supports will be fastened to the exposed panel below the first seam, allowing the rigging to be released from the insulation assembly. Using powered hand tools fitted with appropriate nut drivers, workers will remove the self-tapping hex-head screws releasing the nine panels making up the exposed elevation of reactor vessel insulation. Workers will then reach through vertical seams created by the curtain of lead shielding panel to minimize whole body exposure during the screw removal. The crane operator will remove each panel using a plate grapple attached to the polar crane and load the liberated panels into a 14-195 liner. Each panel is estimated to weigh approximately 180 lbs.

Miscellaneous Waste

Several aspects of the RPV and internals removal and disposal effort will result in generation of miscellaneous wastes. The principal sources of these wastes will be the in-core instrument conduits and supports below the RPV, the access platform in the area below the reactor keyway, the reactor vessel internals lift rig, the control rod drive shafts, the steel and concrete demolished during the preparation effort for the reactor vessel nozzle area, the RPV insulation, final disposition of the RPV and internals segmentation equipment, and miscellaneous dry active waste resulting from the support of various contaminated area activities associated with the RPV and internals removal and disposal effort. Based on anticipated activity levels, all of these items are expected to be Class A waste. Table 4-10 provides a summary of the projected number of miscellaneous waste packages and the associated net weight and total burial volume for this waste.

Table 4-10: DCPP Waste Volume Totals for Units 1 and 2 RPV and Internals Miscellaneous Waste

NRC Waste Class	Number of Packages	Waste Weight (lbs.)	Burial Volume (ft^3)
A	[redacted]	2,059,062.0	[redacted]

Waste Transportation and Disposal

Transportation and disposal of radioactive waste are governed by the NRC regulations defined in Title 10 and the DOT defined in Title 49 of the Code of Federal Regulations. Methods for transporting and disposing all RPV and internals segmentation waste were evaluated separate from those waste streams described in Section 3.3.2 due to the unique processes required to package, transport, and dispose of the highly radioactive waste generated during segmentation activities. Transportation and disposal of all waste generated during RPV and internals segmentation will be performed as part of the RPV and internals removal and disposal activities and are captured within the costs associated with this scope of work. The disposal of radioactive waste generated during RPV and internals segmentation will be at either of two facilities that accept radioactive waste from PG&E. The Energy Solutions, Clive, Utah site is licensed to receive Class A waste. The WCS Andrews, Texas facility is licensed to receive Class A, Class B and Class C waste. There are no facilities currently licensed to receive GTCC waste. Both the Clive and WCS facilities have waste acceptance criteria that require waste to be classified in accordance with 10 CFR Part 61.

It is currently significantly less costly to dispose of Class A waste at the Clive, Utah facility than the Class B or Class C waste that can only be disposed of at the Andrews, Texas facility. For this reason, efforts were made when developing the segmentation and packaging plans to maximize the quantity of Class A waste. Due to the unknown costs for future disposal of GTCC waste, efforts also were made to minimize the quantity of GTCC waste.

The transportation of radioactive material is performed in accordance with the requirements of 49 CFR Part 173. Radionuclide limits defined in 49 CFR 173.435 are referred to as the A2 values for normal form radioactive materials. Radioactive material in quantities less than the A2 values are referred to as a Type A quantity and are transported under the DOT's jurisdiction. Quantities of radioactive material greater than the A2 values are referred to as Type B quantities and are transported under the NRC's jurisdiction in accordance with the requirements of 10 CFR Part 71. Packages that are qualified for shipment of Type B quantities are analyzed to withstand hypothetical accident conditions. This analysis and the associated regulatory review are significant. As a result, the transportation of a Type A package is much less costly than transportation of a Type B quantity. Due to the radionuclide concentrations of the RPV and internals, many of the RPV and internals waste shipments will be Type B quantities.

The waste containers selected for implementing the package plan primarily consist of large capacity liners. [redacted]

[redacted] The waste characterization analysis determined that additional radioactive decay will not appreciably change the required NRC package type until well after the expected decommissioning duration (i.e., no change for greater than 20 years post shutdown). The containers selected to implement the package plan were chosen based on a thorough review of all currently available Type B shipping packages. During review, packages were eliminated from consideration due to size considerations and limitations associated with maximum allowable radionuclide concentrations for waste to be stored and transported within the packages. After this review, three packages remained for consideration -- the AREVA Model TN-RAM, Energy Solutions Model 3-60B, and NAC International Model STC systems. The TN-RAM and the 3-60B Type B shipping packages are essentially identical waste package systems. Segmentation and package plan development using the TN-RAM and 3-60B determined that due to limited available internal volume of these shipping packages, more than 100 total packages and shipments would be required for all RPV and internals waste per unit. Since transportation and disposal costs are incurred for the burial volume of each shipment and not just for the net volume of disposal waste within the containers, use of the TN-RAM and 3-60B packages was deemed unreasonable due to the significantly greater transportation and disposal costs that would be associated with the excessive number of waste disposal shipments needed if these small-volume capacity casks were to be used. Use of the NAC-STC system was determined to be a viable option since it is a large capacity system that has sufficient shielding capability to make transportation possible concurrent with packaging activities.

DCPP currently uses a similar system to the NAC-STC for spent fuel storage, which is designed and provided by Holtec. [redacted] Section 4.1.1.5.1 provides further basis for the assumption to employ Holtec waste storage and shipping systems. To ensure availability of Type B shipping packages required for transporting radioactive materials greater than the A2 values, and to minimize the overall schedule for RPV and internals segmentation and disposal activities, two DCPP dedicated HI-STAR shipping packages will be employed ship the Unit 1 and Unit 2 RPV and internals segmentation waste that is specified within the packaging plan to be loaded in the Holtec high capacity waste containers.

All waste containers loaded into the Holtec HI-STAR shipping packages will be transferred from the site by special purpose heavy haul modular hydraulic transporters and trailers along a permitted heavy haul route to the PG&E rail yard in Pismo Beach, where they will be loaded onto rail car for transport to the specified disposal facility by dedicated rail shipment. [redacted] RPV and internals waste that is intended to be shipped in shielded boxes will be removed from Containment, through the FHB, and then it will be lowered by gantry crane from the 140’ elevation to the 115’ elevation where it will be loaded onto flatbed trailers for shipment to the specified waste disposal facility. The 14-195 liners will be loaded with Class A waste generated during segmentation of the vessel internals along with RPV insulation materials. These liners will be removed from Containment, through the FHB, and then lowered by gantry crane from the 140’ elevation to the 115’ elevation, where they will be loaded into 14-195 casks for shipment to the specified waste disposal facility. The balance of the miscellaneous dry active radioactive waste generated from RPV and internals processing will be packaged and shipped in intermodal boxes. All intermodal box shipments are projected to be shipped by highway on standard flatbed trucks.

4.1.1.5. GTCC Management

4.1.1.5.1. GTCC Storage Construction

Low-level radioactive waste with radionuclide concentrations exceeding NRC limits for Class C is called GTCC waste (see Section 4.1.1.7.2 for a description of Class A, B, and C wastes). An example of GTCC waste would be portions of the reactor vessel internals. Currently, there is no site licensed for disposal of GTCC waste, nor are there any federal disposal facilities licensed to receive GTCC waste. Like spent fuel, all GTCC waste must be packaged and stored at the site where the waste is generated. For example, the HBPP Unit 3 GTCC waste is stored on site at the ISFSI. Storage of GTCC waste requires compliance with specific NRC regulatory requirements, including the type of storage canisters and storage location. GTCC waste will be removed from the plant, reduced in size as necessary (e.g., reactor vessel internals), placed in canisters, and stored on site until the DOE provides a repository for permanent or interim storage. Industry practice has been to place GTCC waste into canisters like those used for dry cask storage and store it with the spent fuel canisters at an ISFSI. At DCPP, the existing ISFSI pad cask placement locations are already fully allocated to store spent fuel. In addition, PG&E’s site-specific license for the DC ISFSI does not currently allow GTCC material to be stored in the ISFSI.

PG&E performed an assessment to determine the optimal storage location for a GTCC waste storage pad and associated costs. A team of technical and environmental experts evaluated eight sites at DCPP for various factors (e.g., geological, technical, environmental, radiological dose, and licensing impacts). Based on the expert team evaluation, the most appropriate location for storage of GTCC waste resides within the existing DC ISFSI footprint. Specifically, the existing DC ISFSI site would be modified to add a storage pad within the existing DC ISFSI footprint to accommodate both spent fuel and GTCC waste casks (see Figure 4-24 and Figure 4-25 below).

Figure 4-24: DC ISFSI with GTCC Waste Storage

Figure 4-25: Elevation View of Canisters on New Pad

NRC licensing, permitting, and storage pad design and construction are required for storage of GTCC waste. The associated design, NRC licensing, and permitting activities are planned to occur prior to final plant shutdown to allow ample time for regulatory reviews, which could take several years. These costs are included in the pre-shutdown planning costs described in Section 4.1.1.1. The storage pad construction would occur after final plant shutdown and would include removing a portion of existing concrete that is not currently used for spent fuel storage and replacing it with a concrete pad that is qualified for spent fuel or GTCC waste storage.

For purposes of this cost estimate, PG&E assumed that a Holtec cask design will be used to store the GTCC waste within the existing DC ISFSI footprint. It is appropriate to assume a Holtec cask design will be used because Holtec already has a site-specific NRC-approved cask design in use at the DC ISFSI and a generically NRC-approved GTCC waste cask design. Other vendors were not considered due to the additional costs associated with the DC ISFSI-specific design and licensing that would be required. Cost estimates for the design, licensing, and permitting were generated based on discussions with ISFSI experts with dry cask storage design, licensing, and permitting experience. The construction cost estimate was developed based on actual project experience from the DC ISFSI Expansion Project completed in January 2015, whose scope and methodology is directly applicable to the GTCC waste storage pad scope, but on a larger scale.

GTCC waste is included as a license termination expense for the GTCC waste storage pad design, licensing, permitting, and construction. This work scope supports both Unit 1 and Unit 2 GTCC waste storage, and the costs are split evenly between the two units (Unit 1 and Unit 2 GTCC Storage Construction).

4.1.1.5.2. GTCC Storage Operations

GTCC storage operations consists of the operation, security, and maintenance activities associated with the storage of GTCC waste in the Unit 1 and Unit 2 SFPs, otherwise known as wet storage, and at the current ISFSI, otherwise known as dry cask storage. These activities include utility upkeep, security systems routine maintenance and testing, concrete pad maintenance, monthly cask inspections, and facility inspections required by NRC regulations. While the operation, security, and maintenance activities are described in this DCE Section, much of the associated staffing and specialty contracts costs are reported elsewhere in Sections 4.1.1.9.4, 4.1.1.9.5, and 4.1.1.9.8 (similar activities associated with the storage of spent fuel in the SFPs are addressed in Section 4.1.2.1.1, while the activities associated with storage of spent fuel at the ISFSI are addressed in Section 4.1.2.2.1).

All SFP and ISFSI facility equipment must be operated and maintained properly to provide the continuous capability to safely store GTCC waste and provide shielding from the radiation given off by GTCC waste.

GTCC waste that has already been removed from the reactors and is stored in Unit 1 and 2 SFPs is referred to as GTCC legacy waste. GTCC waste that will be generated after plant shutdown during the dismantling of the reactor vessel internals is referred to as GTCC segmentation waste. The majority of GTCC waste requiring storage at the plant will be comprised of this segmentation waste and will be transferred to the ISFSI (see Section 4.1.2.3.1) for on-site dry cask storage upon removal from the reactors (see Section 4.1.1.4). After the GTCC legacy and segmentation waste is packaged and transferred to the ISFSI, it will remain there until an approved off-site facility can receive it. Until this occurs, the onsite storage of all GTCC waste must be managed at the SFPs and the ISFSI. GTCC storage operations begins when each unit is permanently shut down and will continue the entire time that the GTCC waste is stored on-site in the SFPs and at the ISFSI, until all spent fuel and GTCC waste have been transferred off-site from the ISFSI (see Section 4.1.2.2.1).

The GTCC legacy waste is stored in SFPs located in the FHB, a steel-framed building anchored to the concrete Auxiliary Building structure. The FHB encloses the two fuel handling areas of Unit 1 and Unit 2 and is a shared structure that contains the SFPs, the fuel handling cranes, fuel racks, HVAC equipment, and other related equipment located on each side of the east end of, and adjacent to, the Auxiliary Building (refer to Figure 4-26).

Figure 4-26: Locations of SFPs

All GTCC waste (in the form of metallic materials) removed from Unit 1 and Unit 2 reactors during power operations, referred to as GTCC legacy waste, will remain in the SFPs until it is transferred to the ISFSI after permanent plant shutdown. The GTCC legacy waste will be retrieved from various storage location baskets in the SFP for eventual transfer to the ISFSI. The amount of GTCC legacy waste from a single SFP will fit into a single storage canister so that the combined volume of GTCC legacy waste being stored in

Unit 1 and Unit 2 SFPs will fit a total of two storage canisters. As a result, two dry casks of GTCC legacy waste will be stored at the ISFSI after they are transferred from the.

Refer to Section 4.1.2.1.1 for detailed descriptions of the SFPs, the facility equipment, operation, security, and maintenance activities associated with the storage of spent fuel; these same descriptions apply to the GTCC waste stored in the SFPs.

All GTCC waste generated after permanent plant shutdown during dismantling of the Unit 1 and Unit 2 reactors, referred to as GTCC segmentation waste, will not be stored in the SFPs and will be transferred directly from the point of generation (Containment Buildings) to the ISFSI after final cask packaging and processing takes place at the Cask Washdown Area on the north end of the Unit 2 SFP. This will result in a Unit 1 and Unit 2 combined total of eight dry casks of GTCC segmentation waste stored at the ISFSI.

The ISFSI is located approximately 0.22 miles northeast of the Unit 1 Containment Building (ISFSI/Containment center-to-center) at an elevation of approximately 310' situated directly on bedrock. It consists of a security boundary and a concrete storage pad that securely anchors the casks storing the spent fuel and GTCC legacy and segmentation waste. Eight casks of GTCC segmentation waste, two casks of GTCC legacy waste, and 138 casks of spent fuel will be stored at the ISFSI once all transfers from the SFPs to the ISFSI are completed. The ISFSI uses a dry cask storage system made by Holtec International, which is the same cask storage system used to store spent nuclear fuel (see Section 4.1.2.3.1 for detailed descriptions of the equipment). The Holtec system provides the radiation shielding, missile protection, and protection against natural phenomena and accidents; the cask anchor bolting provides protection against seismic activity.

All GTCC legacy waste and spent fuel stored in Unit 1 and Unit 2 SFPs and all GTCC segmentation waste is planned to be packaged and transferred to the expanded ISFSI within seven years of Unit 2's permanent shutdown, by June 2032. The DOE is assumed to begin accepting all GTCC waste and spent fuel from DCPP at an off-site facility starting in 2038, with a projected finish of 2067 to complete the transfers, based on the current allotment allowed under the terms of 10 CFR 961, "Standard Contract for Disposal of Spent Nuclear Fuel and /or High-Level Radioactive Waste."

Therefore, the GTCC storage operations activities must maintain the capability to safely and securely store GTCC waste at the ISFSI for approximately 36 years after transfer from the SFPs. During this significant length of time while storage occurs, the ISFSI security systems must be maintained and the condition of the dry casks monitored to ensure the protection of the public health and safety and the environment.

The operation and maintenance of the ISFSI security systems as well as the monitoring of the dry casks must be performed in accordance with NRC requirements. The monitoring of the dry casks requires continuous security resources to ensure that they are protected and daily operations monitoring resources to ensure that their functional requirements remain intact. Other activities, required to ensure the protection of the public health and safety and the environment during the ISFSI storage period, include:

- Performing ISFSI facility maintenance as needed (such as utility upkeep, security systems routine maintenance and testing, concrete pad maintenance, monthly cask inspections, etc.)
- Performing various required annual and semi-annual NRC reporting/facility inspections in accordance with NRC Inspection procedures 36801, 37801, 60855, 60857, 60858, 62801, 71801, and 84750
- Performing Chloride Induced Stress Corrosion Cracking (CISCC) inspections every five years of the spent fuel and GTCC storage canisters, in accordance with NRC regulation NUREG-2214
- Making any specialized equipment available (such as special tooling or inspection equipment)

The costs directly incurred by GTCC storage operations related to SFP storage include:

- Specialty tools and equipment (such as SFP underwater inspection equipment and spent fuel bundle lifting tools)
- Regulatory compliance and inspections staffing (e.g., NRC-required reporting or inspections)

The costs directly incurred by GTCC storage operations related to ISFSI storage include:

- Upgrades to infrastructure (such as design and constructions costs for a new heavy haul dock)
- Specialized work requiring contracts (such as aging management and storage equipment inspections)
- Specialized tooling and equipment (such as those required for specialized inspections of storage equipment)
- Regulatory compliance and inspections staffing (e.g., NRC-required reporting or inspections during storage)
- Permitting compliance (obtaining state or county ministerial permits)

The primary contributors to indirect costs for GTCC storage operations related to SFP storage include:

- The staffing and specialty contract costs that will be incurred for SFP storage facilities operations, maintenance, and security. These staffing and specialty contracts costs are reported elsewhere in Sections 4.1.1.9.4, 4.1.1.9.5, and 4.1.1.9.8.
- Other significant contributors to indirect costs reported elsewhere include the addition of the SFPI, procedure changes, licensing and permitting changes, and engineering. These are described elsewhere in Sections 4.1.1.2.1, 4.1.1.9.10, 4.1.1.9.12, 4.1.1.9.13, 4.1.1.9.3, 4.1.2.6.10, 4.1.2.6.12, 4.1.2.6.13, and 4.1.2.6.3.

The primary contributor to indirect costs for GTCC storage operations related to ISFSI storage include:

- ISFSI storage facilities operations and inspections, maintenance, and security and those activities are reported in Sections 4.1.1.9.4, 4.1.1.9.5, and 4.1.1.9.8.

- Other significant contributors to indirect costs reported elsewhere include those associated with facility and operations procedure changes. These are reported in Section 4.1.1.9.10.

4.1.1.6. Large Components, Systems, and Area Dismantling

Dispositioning large components, plant systems, and area dismantling, known as System and Area Closure (SAC), is a significant element of decommissioning from both safety and schedule perspectives. The structures included in this plan are the reactor Containment Buildings, Turbine Buildings, Fuel Handling Buildings, Auxiliary Building, Intake and Discharge structures, waste holding and Treatment Building, Auxiliary Boiler Building, and the Radiological Waste/Laundry Buildings. Preparing these buildings for demolition requires a detailed plan.

The primary objective of the SACP is to set forth the means and methods to successfully prepare the power block buildings and equipment for safe and efficient demolition by mechanized means. This includes leaving most of the plant equipment and systems in place and performing preparation activities to those remaining systems and the buildings that house them. Decommissioning industry experience has demonstrated that large demolition machines, working in a radiologically and physically safe environment, can reduce commercial nuclear plant buildings to sorted rubble in a relatively short time period. This approach incorporates lessons learned from past decommissioning projects, including Zion Units 1 and 2, SONGS Unit 1, SONGS Units 2 and 3 planning, Rancho Seco, Trojan, Maine Yankee, Connecticut Yankee, and Yankee Rowe.

The secondary objective of the SACP is to develop the overall material inventory of the buildings and building contents. The SAC Plan in conjunction with the Waste Management Plan determine the waste stream quantities expected from the decommissioning project. Specifically, the plans together identify the amount and type of material along with the expected disposal classification in each building, also referred to as a building waste stream.

The SACP presents the bulk preparation activities for each building to be demolished and the specific “surgical” removal activities to be performed to ensure the safe and radiologically controlled demolition of buildings containing contaminated materials. For each building in scope, the SAC process starts with the formal abandonment of the building and ends with a formal turnover of the building with its demolition preparation activities completed.

Early decommissioning projects spent considerable time and labor to surgically remove the contaminated and non-contaminated systems from buildings and areas within the plants. Ultimately, these projects sought to remove the contamination from the remaining structures so that most of the facility could be demolished and hauled away as non-radiological waste. However, early 1990s demolition showed that the ability to access and remove contamination from concrete or to remove activated concrete was terribly unpredictable, causing significant project delays. These delays were associated with the migration of contaminants into unexpected cracks, joints, and other fissures.

This SACP implements the current preferred approach in decommissioning projects by leaving as much of the commodity wastes (e.g., pumps, pipes, tanks, raceways, cabinets) in place for removal during the large demolition machine activities, resulting in better budget and schedule predictability during project execution. During the demolition, the machine operator will separate the metals from the concrete for further processing. The time and costs saved by this approach are significant when compared to the prior method of manually removing the commodities. The industry also has learned through experience that much of the combined contaminated waste can be disposed as exempt material under the provisions of 10 CFR 20.2002 at a licensed facility. This approach lowers the cost per cubic foot of radioactive waste to a fraction of that incurred for Class A disposal.

The term Bulk Building Preparation (BBP) refers to activities that will occur in each building during the preparation of that building for demolition. The BBP activities include the tapping, venting, and draining of systems and piping that will remain in the buildings during the demolition process; air gapping utilities; applying fixatives to contaminated components; removing hazardous/universal wastes, etc.

Complementary to BBP is the surgical, or manual, removal of equipment and piping from the building before demolition. This surgical removal is done to remove highly contaminated sections of systems that could pose a radiological hazard to workers or could cause criteria established for open air demolition to be exceeded. In some limited cases, equipment will be surgically removed to support staging or equipment installation needs of other plans. For the removal of highly contaminated sections of systems, PG&E performed an evaluation to determine which equipment and components should be removed prior to building demolition. Each building in the scope of SAC was evaluated and assessed for the need to remove equipment using arrangement diagrams, piping isometrics, piping and instrumentation diagrams (P&IDs), and rad maps for radiological dose rates and contamination. Using insights from past decommissioning projects and real time input from DCPP operations and RP personnel, systems and components were systematically assessed for the need for surgical manual removal before demolition begins. This process envisioned the establishment of OAD criteria for most of the buildings in scope and set a reasonably conservative trigger for system/equipment removal, which was informed by current plant radionuclide conditions.

Before starting SAC work, buildings and areas of the facility are characterized for contaminants, including radioactive materials and hazardous and regulated materials. SAC is responsible to remove or lock down the radiological hazards so decontamination can proceed to remove the regulated and hazardous materials before demolition.

From a radioactive contamination perspective, buildings and areas are generally classified using the MARSSIM process for consistency. Generally, the MARSSIM approach classifies buildings and areas as described below.

Areas that have no reasonable potential for residual contamination are classified as non-impacted areas. These areas have no radiological impact from site operations and are typically identified early in decommissioning. Areas with reasonable potential for residual contamination are classified as impacted areas. Impacted areas are further divided into one of three classifications, as described in Table 4-11.

Table 4-11: Building and Area MARSSIM Classification Summary

Class	MARSSIM Classification Parameters
Non-Impacted	Structures and areas that have no reasonable potential for residual contamination are classified as non-impacted areas. These areas have no radiological impact from site operations and are typically identified early in decommissioning.
1	Structures and areas that have, or had before remediation, a potential for radioactive contamination based on site operating history or known contamination from results of previous radiation surveys.
2	Structures and areas that have, or had before remediation, a potential for radioactive contamination or known contamination but are not expected to exceed the DCGL.
3	Any impacted structure or area that is not expected to contain any residual radioactivity or is expected to contain levels of residual radioactivity at a small fraction of the DCGL, based on site operating history and previous radiation surveys.

Class 1 areas have the greatest potential for contamination and, therefore, receive the highest degree of effort for the FSS using a graded approach, followed by Class 2, and then by Class 3. Non-impacted areas do not receive any level of survey coverage because they have no potential for residual contamination. Non-impacted areas are determined on a site-specific basis.

Review of the radiological conditions of buildings in the scope of SAC has initially determined that all buildings and areas are likely Class 1 or Class 2 except for the Intake Structure, which is likely non-impacted. Final determination will be made after the units are permanently shut down and the detailed site characterization is completed.

The approach to developing the SAC work scope will use the following outline. All activities are performed under SAC unless otherwise noted:

To develop the SAC Plan work scope, detailed reviews were conducted of the area arrangement drawings in conjunction with review of the radiological survey maps to assess the levels of contamination in each of the power block buildings, including the Intake, Discharge, Waste Holding and Treatment (WHAT), and various other facilities (i.e., the radiological waste buildings, auxiliary boiler, etc.) that are located outside the power block cluster of buildings.

Each area in these buildings was assessed using arrangement diagrams, piping isometrics, P&IDs, as well as rad maps for radiological dose rates and contamination. Using insights from past projects and real-time input from DCPP operation and radiological protection personnel, systems were systematically assessed for surgical manual removal before beginning demolition. This process envisioned the establishment of OAD criteria for most of the buildings in scope and, as such, set a reasonably conservative trigger for system/equipment removal, which was informed by current plant radionuclide conditions.

Site reviews of these systems and components targeted for removal were conducted in representative areas. After the site reviews, the team reassembled and finalized the list of equipment to be removed prior to demolition activities. The equipment to be removed is largely in the Containment, Auxiliary, and Fuel Handling buildings. All remaining equipment is slated to remain in the structures. Some of that equipment will require engineering controls (application of fixatives, grouting, foaming, localized spray rings, etc.). Application of these engineering controls has been estimated and is included in the overall work scope to prepare the building for demolition.

During post-shutdown system characterization, data will be collected on the exterior and interior portions of the piping and equipment to validate the level of engineering controls necessary to prevent gross contamination of the work area during demolition and remain within the OAD release criteria. Engineering controls include exterior equipment fixative application; stabilizing inter pipe contamination via a flowable fixative; use of foam injection; use of spray rings at the demolition machine cutting shear; enclosing and ventilating the work area through a HEPA filter arrangement, and manual removal of the equipment, piping, or component.

Buildings are assessed for the amount of building preparation activities needed to produce conditions acceptable for the selected demolition approach (e.g., clean non-detect, contaminated, or contaminated: OAD).

To the extent possible, contaminated building demolition is best performed under slightly negative pressure, using a monitored release point. Such is the case for the Containment Buildings, which have supply and exhaust fans and an installed process radiation monitor attached to the fans. As part of the consolidated bundle development, a filter housing will be installed in the discharge path of the containment ventilation system. The filter media will be high efficiency to remove particulates in the exhaust stream.

Open Air Demolition has established the criteria to allow contaminated equipment to remain in the building during demolition. The criteria prescribe the level of action to be taken for contaminated equipment -- ranging from no action for slightly contaminated equipment, to requiring the application of engineering controls for mid-range contamination levels, and, in the case of significant contamination, the removal of the equipment from the building prior to demolition. In summary, the OAD criteria uses either equipment removal and/or engineering controls (fixatives, grouting, foaming, etc.) to limit the spread of contamination during demolition activities. Local air sampling is continuously performed during OAD.

A radiological study will be performed for the site’s geographical location to develop an OAD criteria classification scheme. This is initially done using current radionuclide data from the plant to develop the initial removal or remediation plan. When the plant permanently shuts down, the radiological data will be reassessed for changes that may affect the removal/remediation plans. The OAD criteria classification system uses categories summarized in Table 4-12.

Table 4-12: Open Air Demolition Categories

Category	Open Air Demolition Category Descriptions
Category 1	Systems and components present no risk to the OAD limits
Category 2	Systems and components that exceed the residual contamination/activity levels defined in Category 1 and are less than Category 3 condition and can be managed through decontamination techniques or the application of approved engineering controls, (e.g., fixatives or light weight grout)
Category 3	Systems and components that through process knowledge and operating history are likely to exceed OAD upper contamination limits and cannot be managed though decontamination techniques or using engineering controls will require removal

In those cases where little or manageable amounts of contaminants are present (e.g., Turbine Building), the building area would be assessed as a clean demolition candidate (i.e., non-contaminated demolition). This assessment would be based on a reasonable amount of preparatory effort by SAC to remove any source of potential radioactive contamination: air gap, drain, and vent the systems remaining in the building.

In a clean demolition execution, equipment, pipes, valves, etc., may remain in place, and the building demolition crews, using large demolition machines, would demolish and separate concrete and steel into waste containers that are further checked at the waste processing facility for potential free release. The non-radiological portion of the Auxiliary Building appears to be a potential clean demolition; controls would be used to keep the clean and contaminated sections separated.

In those cases where there is significant contamination in the buildings/areas, the area would be assessed as a contaminated demolition effort. In the case of a declared contaminated demolition, preparatory efforts for building/area demolition would include removing equipment with high levels of radioactive contamination and/or using engineering controls to reduce the potential spread of contaminants. These precautionary measures also will ensure the OAD criteria are met during the demolition execution.

The SAC precautionary steps of manually removing equipment that contains sources of high concentrations of contamination before demolition ensures that the waste from the area being demolished in building demolition will not increase its radiological disposal classification (Class A radwaste will continue to be Class A and not B or C). The intermixing of the concrete provides substantial mass over which to average the waste and, in most cases, can help reduce and control the waste class to be in compliance with the 10 CFR 20.2002 waste disposal limits, resulting in significant cost savings on a per-cubic-foot basis.

In those cases where radiation levels are high and/or contamination spread during demolition could adversely affect workers or exceed established safety limits, or could exceed OAD release criteria, actions will be taken to remove/reduce the contamination and radiation levels to acceptable limits before demolition begins. Typically, work crews implement a plan to cut and remove those pieces of contaminated equipment. This equipment is usually tanks, heat exchangers, valves, or other pieces of equipment known to concentrate radioactive materials in its internals.

This plan uses the collective best management practices, lessons learned, and current decommissioning industry practices in preparing for building demolition. The industry has evolved to the understanding that there is no benefit to systematically removing either all systems and/or all large components before demolishing a structure. This understanding is largely based on the fact that machine removal of most equipment is more cost effective and provides better schedule and cost predictability.

During initial development of the DCPP SAC Plan plant systems removal scope, systems were screened using historical plant operating history, past and present RP area survey results, and external component dose readings to target equipment/systems to be removed ahead of demolition. During this review process, consideration was given to system contents and system/component functions and design (e.g., contamination concentrators). From this, an initial list was developed. That list was further reviewed after detailed site reviews of the equipment and areas where they are located. An additional scope of equipment to be removed before demolition also can be found in the large component removal scope. Surgical equipment removal and large component removals are discussed in further detail, within building specific sections later in this section.

The SAC preparation for building demolition is focused on ensuring worker and equipment operator safety through systematic air gapping and removal of all energy hazards (electrical sources, pressurized water, and gas systems, etc.) as well as ensuring the remediation of hazardous materials that could be dispersed during demolition activities. Additional activities are directed at removing high radiological dose and contamination sources that could exceed safe working limits, cause an uncontrolled spread of contamination, or challenge the OAD criteria. These preparation activities are conducted before building demolition starts and include a formal work plan and checkoff list for demolition readiness conducted by the preparation team and the demolition supervision/management.

The current industry practice recognizes that the only systems and/or large components that need to be removed before the onset of demolition activities are:

- Those systems or large components that contain sufficient contamination so that they represent an ALARA concern by emitting high general area dose rates and/or they would cause a significant spread/release of radioactive contamination even in the presence of engineering controls during demolition activities

- A contaminated system and/or large component that is in what is otherwise a “clean” structure. The contaminated system and/or large component is capable of cross-contaminating clean materials if it were left in place during the demolition of the structure housing the contaminated system and/or large component
- The “classic” large components housed within the Containment Buildings (e.g., SGs, pressurizer, RCPs, RCP motors)
- The “clean” large components that cannot be removed by conventional demolition methodologies.
- Systems/components containing hazardous materials that also could be dispersed during demolition and are best abated before demolition by entirely removing the hazard-containing system/component

Large Component Removal Categories

The selected large components have been trifurcated into three separate and distinct categories to coincide with three different means and methods related to the removal of large components.
The three categories are illustrated in Table 4-13.

Table 4-13: Large Component Category Summary

Category	Category Descriptions
Category 1	Radiologically contaminated large components that are to be removed before building demolition activities where they are housed. These large components are intended to be removed as a whole unit and be subsequently prepared onsite for transporting as Class A waste at a waste disposal facility.
Category 2	Clean (non-detect) large components that are to be removed before building demolition activities where they are housed. These large components are being removed in light of the fact that they cannot be removed by conventional and planned demolition methodologies that will be used to remove all the remaining Category 3 large components. These components will be downsized onsite and prepared for disposal as clean waste by the WOG.
Category 3	Large components that are to be demolished along with the structure where they are housed. All Category 3 large components will be dispositioned in a similar manner to the Category 2 large components except for the polar cranes, accumulators, and the pressurizer relief tanks which will be disposed of as Class A LLRW.

Category 1 and 2 large component removal will be further detailed by the building where they are housed. Category 3 large component removal will be detailed in the building demolition scope of work.

DCPP Facility Waste Quantities Master Inventory

As part of the development of the SACP, personnel have compiled a complete commodity material inventory of DCPP for use in creating the decommissioning cost estimate. The selected demolition approach leaves most of the commodity inventory left in the building for removal by the demolition contractor concurrent with the building demolition. The inventory development approach used a team of engineers and estimators to develop the overall inventory of materials, using plant drawings, databases, and plant site reviews.

The materials inventory is closely coordinated with SAC, materials management, large component removal, and building demolition. The overall waste stream will include the civil inventory, consisting of all concrete, reinforcing steel, and structural steel, as well as the commodity metals from piping, equipment, cables, ductwork, etc. Materials that may have some resale value are managed through materials management. The large component removal removes very large commodity components from the plant. SAC captures the inventory of the remaining commodities in the plant, including those commodities removed before demolition. The remaining commodities in the power block buildings will be removed during building demolition. SAC has performed the effort for material quantity estimating and has assigned waste volume removal to the appropriate plans for disposition. All waste materials, including potentially recyclable metals that are not removed by SAC or large component removal, will be removed by building demolition.

The plant commodity inventory captured in SAC accounts for all materials (pipe, valves, pumps, motors, conduit, cable trays, supports, rupture restraints, hardware, platforms, etc.) in the buildings. The materials inventory will become part of the basis for DCPP project's waste quantities that feed into the Waste Management Plan and recyclable materials that feed into the Materials Management Plan.

The commodity and civil inventories were determined by building.

During the actual execution of SAC and waste management work, further radiation surveys, bulk surveying, characterization, and sorting of the waste streams will be performed at the waste processing areas, and the proper disposal path for each shipment will be determined. That determination will be selected from the following choices:

- Free release out-of-state for recycle/reuse (base)
- Free release in state for recycle/reuse (alternate where permissible)
- Free release reuse onsite
- Out-of-state disposal of non-detect material
- Contaminated materials compliant with 10 CFR 20.2002 licensed disposal
- Contaminated materials compliant with 10 CFR 61 Class A licensed disposal

10 CFR 61 Class B and C wastes are not expected to be encountered at DCPP in significant quantities during SAC execution of systems and equipment removal. The RPV and internals segmentation materials

and the resin filter bed wastes generated during final liquid radwaste operations may be Class B and C wastes and will be dispositioned in those plans. These shipments will be planned in a detailed manner because of the potentially high dose rates from the Class B and C materials.

The development of the DCPP Facilities Waste and Inventory list was consolidated and conducted under the activities, management, and supervision associated with System and Area Closure. This approach was selected as an optimal solution to meet the needs of several of the DCPP plans requiring data on the waste stream inventories of specific waste types. The importance of establishing accuracy in the waste quantities has a direct correlation to accurate cost estimates and schedules to accomplish the work needed to dispose of this waste and reusable materials.

System and Area Closure Waste Movement

The System and Area Closure Plan calls for removing certain subsystems consisting of equipment and system components from the plant, as well as isolating sources of electricity, water, gases, etc., to prepare each building for demolition. The preparation of each building includes isolating the building from all hazards that would endanger the crews wrecking those buildings. Generally, those subsystems have been selected to reduce the spread of contamination or of hazardous materials during the physical large-scale demolition. Consequently, based on other commercial nuclear power plant decommissioning experiences, and to implement the current approach at DCPP, System and Area Closure processes will be applied to:

- Containment Buildings
- Turbine Building
- Auxiliary Building
- Fuel Handling Building areas
- Intake Structure
- Rad Waste and Laundry area
- Selected Balance of Site areas

Waste generated through work activities associated with the SAC Plan will be placed onto transport waste bins, wheel barrows, dollies, or other transport equipment at the work location. It will then be moved to a preselected waste staging area in the building that has been agreed to by the WOG. The system and area closure work teams will load the building work wastes into the pre-supplied waste containers at the staging area. WOG will supply waste containers at the preselected staging area in the building and will periodically replace them with empty containers. WOG also will transport the full waste containers from the staging area to the waste processing area for further processing to include waste volume, type, classification, chemical makeup, and waste matrix. All system and area closure generated wastes will be weighed, and volumes will be estimated. This data will be recorded in the work plan document and supplied to WOG.

System and area closure contaminated wastes will be processed and packaged for disposal in a radioactive licensed disposal facility. Shipments of radwaste will be managed by WOG.

RCRA waste will be initially packaged at the abatement location and further classified and processed into over-the-road compliant waste transport containers at the waste processing area. RCRA waste definitions will comply with California regulations.

According to current estimates, the surgical removal of equipment in the SAC Plan will generate a considerable amount of radwaste. While the waste quantities generated from the SAC Plan equipment removals are small compared to the overall quantities to be disposed of, there will be a need in the Waste Management Plan and Transportation Plan to package and truck intermodal containers from the site.

<u>Large Component Removal Waste Movement</u>

The Large Component Removal Plan identifies the removal of large components from three buildings:

- Containment Buildings
- Turbine Building
- Balance of Site (e.g., OSGSF)

Waste generated by removing large component will be transported, handled, processed, and disposed of, depending on what type of waste it is and what category it falls under. There are two types of waste -- Class A LLRW and “non-detect” materials – and three categories. All Category 1 large components are Class A LLRW. All Category 2 large components are “non-detect” materials that will be processed and repurposed as scrap metal outside of California. All Category 3 large components will be dispositioned in a similar manner to the Category 2 large components except for the polar cranes, accumulators, and the pressurizer relief tanks, which will be disposed of as Class A LLRW.

- Disposal of Class A LLRW large components: All Category 1 large components will be packaged and disposed of as a complete unit. These components will be transported by specialized vehicles to an out-of-state disposal facility. Transportation and disposal of all Category 1 large components are included in the total cost of large components, System and Area Closure, as noted in Section 3.3.2. The accumulators, pressurizer relief tanks and the polar cranes are Category 3 large components, which will be segmented, downsized, and packaged for disposal when the interior of each Containment Building is demolished.
- Disposal of “non-detect” waste materials large components: The segmented portions of the Category 2 large components will be rigged to the Turbine Building’s overhead crane and then lowered to an elevation of 85’ in the Crane Service Bay area and set in/on a trailer, dump trailer bed, within an intermodal, a flatbed trailer, etc., provided by the WOG. The WOG’s personnel will move the segmented Category 2 large components to the designated staging area, where the MMG will downsize and prepare the ferrous and non-ferrous metal materials for recycling

purposes as scrap metal outside of California. Clean Category 3 large components will be processed from the point of origin to the waste processing area by WOG during building demolition (See Section 4.1.3.2).

The total cost of Large Component, System, and Area Closure is contained in Table 4-1.

4.1.1.6.1. Containment Building

The removal of certain subsystems and components from Containment for demolition preparation will be largely focused on the removal of high dose and/or high contamination sources that could adversely affect the continuity of demolition operations because of an industry safety challenge, a gross spread of contamination, or challenge to the OAD criteria. Other specific components will be selectively removed from the upper elevation of each Containment structure to provide space for reactor vessel and reactor vessel internals segmentation.

The Containment Buildings for Units 1 and 2 are essentially identical but are mirror images. Each is a steel-lined, reinforced concrete building of cylindrical shape with a dome roof that completely encloses the reactor and reactor coolant system. The Containment substructures include the external concrete shell, base slab, liner, internal concrete structure, penetrations, hatches, and steel annulus structures.

The Containment exterior shell consists of a 142-ft. high cylinder. The minimum thickness of the concrete walls is 3.6 ft., and the minimum thickness of the concrete dome is 2.5 ft. Both have a nominal inside diameter of 140 ft. and a nominal inside height of 212 ft. The concrete base slab is 153 ft. in diameter with a minimum thickness of 14.5 ft., with the reactor cavity near the center. The inside of the dome, cylinder, and base slab is lined with welded steel plate, which forms a leak-tight membrane. The nominal thickness of the steel liner is 3/8 inches on the wall and dome, and the nominal thickness of the steel liner on the base slab is 0.25 inches.

The internal concrete structure approximates a 106-foot-diameter, 51-ft. high cylinder, with a slab on top. There are multiple openings and walls, such as the reactor shield wall and the stainless steel lined refueling canal. The walls and top slab are generally 3-ft. thick. This structure provides support for the reactor and components of the reactor coolant system, provides radiation shielding, and provides protection for the liner from postulated missiles originating from the reactor coolant system. A polar crane is mounted on top of the internal concrete cylinder wall.

The piping and electrical connections between equipment inside the Containment structure and other parts of the plant are made through specially designed, leak-tight penetrations. Additional penetrations include the 18-foot 6-inch diameter equipment hatch, the 9-foot 7-inch diameter personnel hatch, the 5-foot 6-inch diameter personnel emergency hatch, and the fuel transfer tube.

Annulus platforms are structural steel platforms at elevations 117' and 140', located between the circular crane wall and the exterior shell. Steel framing is also provided at elevations 106'-8” and 101'-5” to support piping. The framing system is anchored to the internal concrete structure, also called the crane wall. Vertical support is provided by the crane wall around the inner perimeter and by the concrete base slab at elevation 91 ft. around the outer perimeter of the annulus. The annulus framing system is not attached to the exterior shell of the Containment.

The plant vent (6-ft. 7-inch by 13-ft. ventilation duct) is attached to the outside of the structure, extending from an elevation of 25' above the base slab to the top of the dome. The duct is fabricated from steel plate with stiffeners.

As currently envisioned for DCPP, select equipment associated with the RHR system, letdown, charging, safety injection systems, and select components located on the 140’ elevation (to create floor space for RPV and internals segmentation) will be removed by the SAC Plan ahead of building demolition operations. Contaminated equipment and piping deemed to meet OAD Category 2 contamination criteria will be treated by applying a fixative to lock down as much contamination as possible. Equipment and piping deemed to meet OAD Category 3 contamination criteria or above will be surgically removed before demolition. In some cases, engineered controls can be put in place to minimize contamination spread.

Each Containment Building’s interior will be demolished while the containment ventilation and discharge radiation monitoring system is operating in order to have a monitored release point. It is expected that a filter system will be added to the containment exhaust as a precaution against unplanned releases. It will be necessary to maintain a slightly negative pressure in the Containment Building during interior demolition. This will necessitate the closure of some of the Containment openings during demolition. It is expected and planned to have a closure door on the Containment construction opening that will be created in the Large Component Removal Plan. Other Containment penetration openings will be sealed with a sturdy cover as piping and wiring is terminated on the exterior of the building.

The SAC work activities associated with the Containment Building will be performed by an oversight team with subcontractors. The mobilization phase will include locating their staff on-site, moving equipment on-site, site reviews of the job locations, planning and site preparations.

The Containment Building planning and site preparations will include the following:

1.) Prepare a dismantling and removal sequence for the Containment Buildings
2.) Procure radioactive waste containers
3.) Develop detailed work packages for execution
4.) Develop any engineered or rigging lift plans
5.) Develop any design documents that may be required to maintain structural integrity of the building during contaminated equipment removal

The sequence of operations needed for Containment bulk building demolition preparation and advanced surgical removal of contaminated components/systems is as follows:

1.) Confirm that all hazardous and/or regulated materials associated with the building and advanced removal components have either been remediated or abated
2.) Disconnect all electrical power supplies, with disconnection confirmed by a qualified independent third party
3.) Air gap, both electrically and mechanically
4.) Hot tap the system, tank, or vessel to drain all the liquid
5.) Remove all interferences
6.) Remove all thermal insulation either on the advanced removal components/systems or along proposed cut lines
7.) Remove all unnecessary support brackets, anchor bolts, bracing, etc.
8.) Encapsulate open ends of removed components/systems to limit spreading of internal contamination during removal from the Containment Building and transport to the waste disposal container

For both DCPP Containment Buildings, the expected waste movement will be initiated inside the buildings using the polar crane, auxiliary cranes, and/or local overhead rigging to load one- to two-ton containers of materials at the different locations or elevations of the building where system equipment is being removed. Since all the material in Containment is expected to be contaminated, those containers would be either driven by forklift from the construction opening to the waste handling area, or dumped into an intermodal shipping container, which would also be transported to the waste handling area for further assessment and processing.

Remediation and removal methods will be used for hazardous materials in the Containment Buildings to prepare for demolition. As discussed in the Decontamination Plan, hazardous materials to be removed include containerized oils, asbestos-containing materials, PCB-contaminated fluids, lead paint, liquid paints, solvents, and all other RCRA-listed hazardous wastes. As stated in the SAC Plan, universal wastes to be removed as part of building preparation include mercury switches, lighting ballasts, batteries, electronics, bottled gases, florescent and other lights. These wastes will be packaged and handled at the time of removal in accordance with the acceptance criteria of the RCRA waste disposal facilities.

Large Component Removal Details – Containment Building

Category 1 large components (radiologically contaminated large components) will be removed before the Containment Buildings are demolished to provide staging space for reactor vessel and reactor vessel internals segmentation. Within the contaminated areas, these components are best removed in either a whole or segmented condition and will be described in further detail for each specific component. The large components removed from the Containment Buildings will be packaged and disposed of as Class A low-level radioactive waste.

The Large Component Removal (LCR) scope within the Containment Buildings includes 11 components per unit. These include four SGs, one pressurizer (PZR), four RCPs, one reactor head with integrated head assembly (IHA), and one manipulator crane. To comply with suspended heavy load requirements and safety of the workers within the Containment Buildings, these components will be removed after all spent fuel has been removed from the reactor vessel. The component size, weight, and configuration will determine the removal strategy. Removing these large components intact as much as possible is often preferred in order to minimize radiological cross contamination and safety issues that arise during disassembly and the cost reductions achieved through schedule efficiency.

The planning and execution for this scope of work is scheduled for a nominal 40-hour work week. The planning will start approximately 24 months before initial execution and continue into the execution phase. The execution phase of the LCR scope of work is scheduled for approximately 48 months with the completion handoff to System Area Closure and Reactor Vessel Segmentation.

The work activities to remove these specific large components will be performed by a contract team with subcontractors. Contractor work starts with mobilization, which includes locating their staff on-site, moving equipment on-site, site reviews of the job locations, planning, and site preparations. To plan and prepare the site for removing these large components, the large component removal contractor will develop a detailed dismantling and removal schedule sequence, detailed work packages to support execution, engineering and rigging lift plans, and engineering design documents as appropriate. The contractor also will be required to procure radioactive waste containers for those components that are not self-contained.

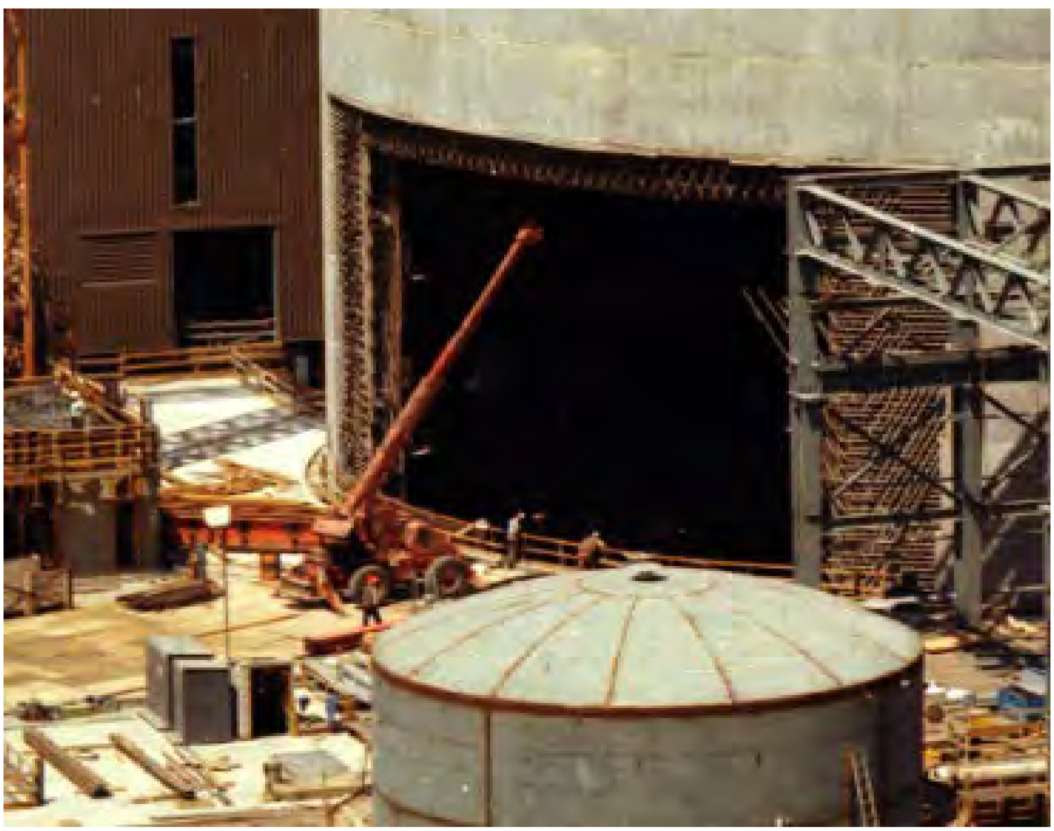
A Specialty Contractor will be used for the heavy rigging, component movement/transportation, concrete cutting, and reactor coolant piping severing. Industry experience has shown that for these work scope activities, specialty contractors have a unique skill set and tooling capabilities. All heavy rigging will be performed in a controlled and pre-planned manner.

Before a large component is removed, it will be confirmed and independently verified that all hazardous and/or regulated materials associated with the component have either been remediated or abated and all electrical power supplies have been disconnected. The contractor will perform electrical and mechanical air gaping, remove all interferences around the large component or load path, remove all thermal insulation from the large component, and remove support structures for the large components. The specific details of these activities are described for each of the large components in this scope of work.

With limited access in each Containment Building, the removal strategy requires several different considerations, including rigging and modifications to the Containment Building, to maneuver and extract large components from the structure. For each unit, the large component activities can start after the fuel has been removed from the respective reactor vessel and submittal of a certification of permanent cessation of power operations to the NRC as specified by 10 CFR 50.82(a)(1)(i) and certification of permanent fuel removal to the NRC as specified by 10 CFR 50.82(a)(1)(ii).

Construction Opening: An access opening (referred to as construction opening) will be built in each Containment Building to facilitate a safe and more efficient removal of these large components. The construction opening also will be used to support the reactor vessel internals and the reactor vessel segmentation activities. The construction opening will be created at the operating floor elevation or elevation 140'. Locating the access opening at this elevation will require the installation of a suitably sized elevated transfer cart system to move large components, materials, waste containers, segmentation equipment, and tooling, etc., in and out of the Containment Buildings at the operating floor's elevation. The Containment construction opening will be sized to accommodate a GTCC disposal canister and transfer cask (equal in size to a spent fuel canister and transfer cask) and its transporter. The construction opening will be approximately 30 ft. high and 30 ft. wide and will be equipped with closures (or doors) to prevent the spread of contamination (see Figure 4-27).

Figure 4-27: Construction Opening During Early Construction of DCPP Unit 1



There are three ways to cut and/or demolish thick concrete wall sections to create the construction opening in each of the Containment Buildings:

1.) Wire saw cutting technology
2.) Hydrolazing "washing" technology

3.) Hydraulic hoe-ram affixed and attached to a long dipper stick on a hydraulic excavator

Wire Cutting Technology was selected after considering its advantages, given the amount and diameter of the reinforcing bar in the Containment Building's outer concrete shell; the other two options cited above are not viable for the following reasons:

Option 1: Wire Saw Cutting Technology

Advantages	Disadvantages
Wire saw cutting provides the ability to cut through any size and thickness of concrete and steel.	Operate at a much slower speed
These include the fact that it is dust-free, producing fewer wasted materials compared to conventional solid blades, and that it produces little to no noise so there is no risk of hearing damage or disruption to people working nearby.	Potential (low) for the wire to break, typically need to change entire wire when this happens
Consumes significant less water than hydrolazing and can be used dry	
Ideal solution when a job requires extremely thick concrete to be cut. Wire sawing is the most practical option and technique for cutting through structures and cross sections that are too large to be cut practically using any other method.	

Option 2: Hydrolazing "Washing" Technology

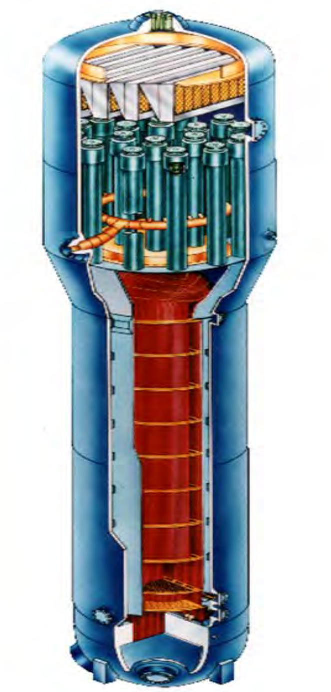
Advantages	Disadvantages
Minimizes disruptions to users of occupied space by significantly reducing transmitted sound through the structure	Consumes a significant amount of water that would need to be processed for reuse or disposal
Increased speed of concrete removal can reduce construction time	The water jet does not cut reinforcing steel, the reinforcing steel would need to be cut using other techniques, more time.
During demolition, cleanup, and final wash down, the concrete debris and repair surface remain wet, minimizing dust in the work area.	Even with the water jet being shrouded, debris can be propelled from beneath the shroud with sufficient velocity to cause serious injury.
	Serious injury or death can occur if struck by the water jet.

Option 3: Hydraulic Hoe-Ram

Advantages	Disadvantages
Can be used without water, or with minimal amount for dust control	The sound of the hammer blows, combined with the explosive air exhaust, makes hydraulic hoe-ram dangerously loud, emitting 100 decibels at two meters.
Typically, smaller concrete debris, easier to handle	Hydraulic failure can result in significant cleanup or repairs.
	Will not remove re-enforcing steel (rebar), need to deploy another cutting tool, more time
	The potential for airborne silica that may require water spray mitigation and the cleanup and disposal of that water
	The potential for airborne release of radioactive material when the ram breaks through the inner layer of concrete

The Abrasive Wire Saw (AWS) cutting will be the preferred method for removing concrete. The concrete blocks removed will be cut into smaller manageable pieces. These pieces will be loaded into waste containers for disposal, which will be transported to the on-site waste staging area and prepared for shipment to an out-of-state disposal facility.

Abrasive wire saw equipment setup to cut small concrete sections



Steam Generators: Each unit has 4 Model Delta 54F (U-Tube design heat exchanger) SGs installed. The SGs are mounted in a vertical position and stand approximately 68' tall with a 17' diameter along the upper portion (at the steam drum) and 11 ½' diameter along the bottom portion (at the primary nozzles section) with a weight of approximately 760,000 lbs. The bottom of the SG is at the 104' elevation where the reactor coolant enters and exits. The SG extends vertically to the 172' elevation where the steam exits the steam dome. On the primary side (contaminated) of the SG, a stainless steel 29" diameter inlet and 31" diameter outlet piping connects the SG to the reactor coolant system. On the secondary side (non-contaminated) of the SG, feedwater is pumped into the side of the SG through a carbon steel 16" diameter pipe, and steam exits the SG through carbon steel 28" diameter pipe out of the top. This closed system transfers the heat from the reactor through 4,444 U-tubes, which produces dry steam to rotate the steam turbines. The tube and tube sheet boundary are designed to prevent the transfer of radioactivity generated within the core to the secondary system.

Scaffold structures will be erected in several locations around each of the SGs to safely gain access to insulation, piping, and other obstacles (interferences) to be removed. To prepare for SG removal, all thermal insulation covering the SG and associated piping will be removed and placed in waste containers. In addition, other interferences around the SGs such as handrails, steel platforms, supports, hangers, snubbers, and instrumentation will be removed by mechanical or thermal cutting as needed to provide adequate access and clearance around the large bore piping for pipe cutting machinery. These interferences will be segmented by mechanical or thermal cutting into manageable size pieces, which will be loaded into waste containers for disposal. The waste containers will be transported out of Containment and prepared for shipment to an out-of-state disposal facility by the WOG. Large diameter steam and feed water piping, as well as other smaller instrumentation, sample, and blowdown piping, will be severed by mechanical or thermal cutting from the SG. A sufficient length of piping will be removed during the severing activity to eliminate any possibility of interference during the lifting and movement activity. The reactor coolant system hot leg and reactor coolant system crossover leg will be severed using remote operated pipe cutting machine tools.

In addition, partial removal of the concrete walls and structural platforms surrounding the SG at the 140' elevation will be removed to allow safer and easier removal. The preferred method for removing the concrete walls will be diamond wire cutting. The structural platforms will be removed by mechanical or thermal cutting. A slide or rail system will be built on the 140' elevation of Containment for moving the SGs out of Containment. To provide sufficient lifting height and capacity to lift the SGs out of their cubicles, a temporary lifting device (TLD) system will be erected onto the existing polar crane. Special lifting trunnions will be attached to the SGs and rigged to the TLD; the SGs will then be hoisted out of the cubicle and placed onto the cart or rail system. This process will orient the SGs from a vertical to horizontal position. Each of the SGs will be removed as a complete unit from Containment and transported using SPMTs to the temporary RCA located at the OSGSF that has been prepared for further segmentation. This temporary RCA will be established before the removal of the legacy large components that are stored in the OSGSF and are described later.

Each SG will be moved into the temporary RCA enclosure and the segmentation tooling will be attached to the SG shell at the upper transition piece. The segmentation tooling will be a track mounted thermal cutter. The steam dome will be thermally cut at the top of the transition cone, seal plate welded at the cut line, and prepared for rigging using a temporary gantry crane. The steam dome will be lifted and placed on a SPMT and transferred to a nearby on-site processing area for further preparations for transportation. A seal plate will be welded onto the lower section at the top of the transition cone to seal off the lower shell. This plate will be designed as radiation shielding. When the seal plate welding has been completed, the lower shell of the SG will be transferred out of temporary RCA onto a SPMT and moved to a nearby on-site processing area for further preparations for transportation. The remaining SGs will be removed using the same technique. Once SG sections are in the SG processing area, final preparations for Class A radioactive waste will be completed. Package preparation activities as specified in 10 CFR 71 and DOT regulations include installing radiation shielding (of sufficient thickness to meet DOT transportation requirements) around the exterior of the primary side; decontaminating and coating the exterior with a fixative to achieve contamination limits specified in 10 CFR 71 and DOT regulations; and injecting low-density cellular concrete (LDCC) into the primary side and secondary side voids to fix loose surface contamination.

Each SG section will be placed and secured onto a transportation cradle, compatible with an overland transporter. Each SG section will then be loaded onto a multi-wheeled vehicle and transported to an out-of-state disposal facility. The SG sections will travel with the appropriate state and/or local authorities escorting the shipment. The escorts are mainly used for traffic control; however, a support team also will travel with this shipment to move any interferences (road signs, lift wires, etc.). The transportation contractor will secure all the necessary permits and coordinate with the state/local agencies for transporting the SGs to the disposal site. The transportation of each SG has an approximate 14-day turn-around.

Steam Generator being transported to a specified storage area.

Pressurizer: Each unit has one PZR, located between the reactor vessel and #2 SG. The PZR is vertically mounted with reactor coolant piping welded to top and bottom nozzles. The PZR is approximately 53' long, 8'6" in diameter, and weighs 222,971 lbs. The PZR also has 78 emersion heaters that penetrate the bottom section. The bottom of the PZR (liquid region) is connected to RCS Loop #2 hot leg through a 12" diameter pipe called the surge line and connected at the top through a 4" diameter pipe from either Loop #1 or #2 cold leg called the spray line. The pressure is maintained in the PZR by energizing heaters to increase pressure and initiating sprays to decrease pressure. The PZR is housed in a concrete cubicle that extends from the 140' elevation to 176' elevation with personnel access at the 140' elevation and a small opening at the top. The concrete cubicle provides shielding to minimize radiation dose to the general area at the 140' elevation and above. To help remove the PZR, partial removal of the PZR cubicle roof and wall will be necessary. The concrete will be cut into smaller manageable pieces, loaded into containers, transported out of Containment and prepared for shipment to a disposal facility by the WOG.

Scaffold structures will be erected in several locations around the PZR to safely gain access to insulation, piping, and other interferences to be removed. To prepare for removing the PZR, all thermal insulation covering the PZR and associated piping will be removed and placed in waste containers. The waste containers will be transported out of Containment and prepared for shipment to a disposal facility by the WOG. In addition, other interferences around the components such as handrails, platforms, hangers, snubbers, heaters, and instrumentation will be removed as necessary to provide adequate access and clearance around the components. All waste generated from the removal of these interferences will be loaded into containers, transported out of Containment and prepared for shipment to a disposal facility by the WOG. The RCS piping will be severed from the PZR using remotely operated pipe cutting machines, and the openings on the PZR will be sealed with metal covers and welded for shielding and contamination controls. The cutting tools can be operated remotely to minimize radiation dose to the workers. The PZR will be rigged using slings and trunnions mounted to the PZR shell and lifted using the polar crane. Once the PZR is lifted out of its cubicle, it will be moved to an open space at the 140' elevation. The PZR will be placed on down ending equipment and lowered to a horizontal position on a transport system. The transport system will transfer the PZR through the construction opening to a transporter. The PZR will be transported to a designated preparation area to be prepared for shipment. The PZR will be prepared as Class A low level radioactive waste package that meets 10 CFR 71 before it is moved from the site. The design of the packages will be reviewed and approved by the NRC in accordance with 10 CFR 71.

Package preparation activities as specified in 10 CFR 71 and DOT regulations will include verifying that all openings such as nozzles, penetrations, and instrument connections are sealed closed with metal covers, and welded; filling the PZR with LDCC; decontaminating and coating the exterior of the vessels to achieve contamination limits specified in 10 CFR 71 and DOT regulations; and attaching exterior radiation shielding, as required, to achieve dose limits specified in DOT regulations. The PZR will then be loaded onto a multi-wheeled vehicle and transported to an out-of-state disposal facility. The contractor will secure all the necessary permits and coordinate with local agencies for transporting the PZR to the rail head.

Reactor Coolant Pumps: Each unit has four RCPs; they are vertical single-stage centrifugal pumps powered by a single speed 6000 high pressure (HP) motor. Each RCP (pump/motor combination) is 45'3" in length, 6'6" diameter and weighs 198,000 lbs. Each RCP is designed to pump 88,500 gpm and moves the reactor coolant fluid through the reactor and SGs. The pumps are welded to the reactor coolant piping with 33" pipe suction and 27 ½" pipe discharge and located at the 117' elevation close to the SGs.

Reactor Coolant Pump motor

Scaffold structures will be erected to safely access thermal insulation, small piping, instrumentation, and motor terminations. To prepare for removing the RCP pump as a complete unit, it will be necessary to sever small piping and remove thermal insulation coverings. In addition, other interferences around the RCP such as handrails, hangers, snubbers, and instrumentation will be removed as necessary to provide adequate access and clearance around the RCP. All waste generated from the interferences will be loaded into waste containers as directed by the WOG for disposal. The waste containers will be transported out of Containment and prepared for shipment to an out-of-state disposal facility by the WOG. The RCP motor and pump will be separated at the motor standoff; the motor will be lifted off the pump and transported out of Containment to a designated area, where it will be prepared for transport to a disposal facility. The reactor coolant piping will then be severed by using remotely operated pipe cutting machines at the pump suction and discharge nozzles. The cutting tools can be operated remotely to minimize radiation dose to the workers. Once the RCS piping has been severed, the piping will be sealed by welding covers on the openings. The RCP pumps will be lifted out intact and placed in a specially designed shipping container or wrapped in plastic. The container will be placed on a cart to be transferred out of Containment through the construction opening. The container will be moved to a designated area for shipping and transported for disposal. The RCP will be packaged in special fabricated containers and prepared for shipment to a disposal facility in accordance with 10 CFR 71. Each RCP pump and motor will then be loaded onto a multi-wheeled vehicle and transported to an out-of-state disposal facility. The contractor will secure all the necessary permits and coordinate with local agencies for transporting the RCPs to the rail head.

Reactor Head with IHA: Each unit has one reactor vessel closure head with an IHA. The reactor vessel closure head is a carbon steel cylindrical dome internally cladded with corrosion resistant metal and is the pressure boundary when bolted onto the lower reactor vessel. The closure head has 53 rod travel tubes attached that extend 12' 9" from the vessel flange (17' 1" in diameter) which are part of the pressure boundary of the reactor coolant system. The reactor vessel head with the IHA weighs 370,000 lbs. The reactor vessel head houses the control rod drive mechanisms (CRDM) and has penetrations for the core exit thermocouples. The IHA is designed to support the coils for the CRDMs, the digital rod position indicators (DRPI), missile shield, cooling fans, shielding and lift fixture. The IHA consist of four removable sections: air plenum, upper shroud, middle shroud, and lower shroud. The reactor head will be placed on the existing head stand during disassembly of the reactor and removal of the fuel.

The IHA will be disassembled starting from the top by unbolting the air plenum from the upper shroud and rigged by the polar crane. The air plenum will be lowered to the 140' elevation for further segmentation by mechanical means into small manageable pieces and will be loaded into waste containers as directed by the WOG for disposal. The waste containers will be transported out of Containment and prepared for shipment to an out-of-state disposal facility. This process will be repeated for remaining sections of the service structure, CRDM coils, DRPIs and small-bore vent piping/valves. After all the IHA components have been removed, the reactor vessel closure head will be prepared for placing into a special container. The reactor vessel closure head will be segmented by mechanical means to an "oversize debris" disposal specification in lieu of transporting the closure head as a whole unit ("large component"). This will reduce the cost of transportation and disposal. All the segmented pieces of the closure head will be packaged into waste container as class A radioactive waste. The waste containers will be transported out of Containment and prepared for shipment to an out-of-state disposal facility.

Reactor Head w/IHA

Manipulator Crane: Each unit has one manipulator crane designed to move reactor fuel to/from the reactor vessel to/from the fuel transfer system. This crane is a gantry design that travels on crane rails on the 140' elevation east/west that spans over the refueling cavity. The manipulator crane has a footprint approximately 13 ft. by 27 ft. and is approximately 30 ft. tall with an 11 ft. mast that's below the operating deck and weighs approximately 19,000 lbs. The manipulator crane will be used for the final removal of all the spent fuel from the reactor vessel to the transfer system. Once all the spent fuel has been removed from the reactor vessel, the manipulator crane will be parked to the furthest east position. The manipulator crane will be removed to support reactor vessel segmentation activities. The manipulator will be separated from its electrical and pneumatic power supplies. The manipulator crane will be disassembled or segmented by mechanical or thermal means into manageable size pieces while in its parked location. The segmented pieces will be loaded into waste containers, which will be transported to the on-site waste staging area for further processing and shipment to an out-of-state disposal site by the WOG.

4.1.1.6.2. Turbine Building

The removal of subsystems in the Turbine Building will be largely associated with hazardous materials' remediation and removal. It is expected that a few areas in the Turbine Building will require removal of radioactive contaminated equipment and subsystems; this includes piping and components associated with the SG blowdown system and the liquid radioactive waste piping. The Decontamination Plan will remove hazardous materials, including oils, asbestos-containing materials, PCB-contaminated fluids, liquid paints, solvents, and all other RCRA-listed hazardous wastes. These wastes will be collected at the waste generation site and packaged at the time of removal in accordance with the acceptance criteria of the RCRA waste handling facilities. Further waste packaging will be performed after the waste containers leave the Turbine Building and are transported with a forklift to the on-site waste processing area.

The Turbine Building is located adjacent to the west side of the Auxiliary Building. Unit 1 and Unit 2 are on opposite ends of the Turbine Building and are alike, with each one containing equipment for its unit. Exceptions are the presence of a machine shop and material storage area common to both units in the Unit 1 portion and the on-site Technical Support Center (TSC) in the Unit 2 portion.

Main floor levels in the Turbine Building are at elevations 85', 104', 119', and 140'. The foundation of the building is at elevation 85'. The Turbine Building is a reinforced concrete shear wall structure with a structural steel moment resisting and braced frame structure extending from elevation 140' to elevation 217'. Shear walls generally range from 16 to 29 inches thick. Floors are 10- to 12-inch-thick reinforced concrete slabs or ½-inch-thick steel plate, supported on steel framing and steel columns. The reinforced concrete foundation mat is generally 3 ft. thick except under the turbine pedestal, where the thickness is 10 ft. Reinforced concrete turbine pedestals, one for each unit, are in the building; six piers of each pedestal are post-tensioned. The pedestals are structurally isolated from the building floors and extend from the common foundation slab, elevation 85', to elevation 140'. Two 135-ton overhead cranes are in the building.

Immediately next to the Unit 2 area of the Turbine Building, on the second floor of the polisher buttress area, is the on-site emergency plan TSC. The TSC plays an important role in the existing emergency plan functions for on-site assessment and mitigation of plant accident conditions. The plant security CAS is located within the Turbine Building. Based on the extensive communication, alarm infrastructure, and plant security monitoring function provided by the CAS, an evaluation has determined that delaying the teardown of the Turbine Building will provide cost savings by not requiring the relocation or building of a new CAS while spent fuel and GTCC waste remain within the current PA. Last, teardown of the Turbine Building is limited by its physical interaction with systems that will remain in service to provide SFP cooling until the SFPI phase of the project is completed. These systems include the ASW and Component Cooling Water systems. SFPI implementation is described in Section 4.1.1.2.1.

It is expected that a few areas in the Turbine Building will require removal of radioactive contaminated equipment and subsystems. For instance, the Turbine Building sumps are assumed to have very low levels of detectable contamination present, based on past plant operating history of draining secondary side condensate to the floor drains. Minor past tube leaks may have contaminated the original SGs before their replacement; as a result, the Turbine Building sumps may have been contaminated from condensate leaking or drained into the turbine floor sump. After the shutdown of Units 1 and 2, the sumps will be cleaned out and rinsed as part of the building preparation process. During Turbine Building demolition, those sumps and embedded piping will be removed, surveyed, and they may be disposed of as contaminated waste depending on survey results. During foundation removal, appropriate radiological material controls may need to be established based on the as-found conditions.

The SAC work activities associated with the Turbine Building will be performed by an oversight team with subcontractors. The mobilization phase will include locating their staff on-site, moving equipment on-site, site reviews of the job locations, planning and site preparations.

The Turbine Building planning and site preparations will include:

1.) Prepare a dismantling and removal sequence for the Turbine Building
2.) Procure radioactive waste containers
3.) Develop detailed work packages for the execution
4.) Develop any engineered or rigging lift plans
5.) Develop any design documents that may be required to maintain structural integrity of the building during contaminated equipment removal

The sequence of operations that applies for turbine bulk building demolition preparation and advanced surgical removal of contaminated components/systems is as follows:

1.) Confirm that all hazardous and/or regulated materials associated with the building and advanced removal components have either been remediated or abated
2.) Disconnect all electrical power supplies, with disconnection confirmed by a qualified independent third party
3.) Air gap, both electrically and mechanically
4.) Hot tap the system, tank, or vessel to drain all the liquid
5.) Remove all interferences
6.) Remove all thermal insulation either on the advanced removal components/systems or along proposed cut lines
7.) Remove all unnecessary support brackets, anchor bolts, bracing, etc.
8.) Encapsulate open ends of removed components/systems to limit spreading of internal contamination during removal from the Turbine Building and transport to the waste disposal container

The transportation of the Turbine Building wastes during the SAC Plan work will be done using covered waste bins on roller carts starting at the point of removal, and then moved to the access opening(s) found through the elevations of the Turbine Building. The carts will be lowered to the 85' elevation using the gantry or a staged set of portable cranes located near each elevation hatchway. At the 85' elevation, the waste bins will be loaded into the clean or contaminated waste containers (depending on the rad decontamination technician's initial assessment) that will be provided by WOG. WOG will then transport the full containers to the waste processing area and restock the empty containers in the approved WOG waste collection area in the building.

Large Component Removal Details – Turbine Building

Specific non-contaminated large components will be removed before the Turbine Building is demolished due to their size and weight. Within the non-contaminated areas, these specific components are best disposed of in either a whole or segmented condition.

The work activities to remove these specific large components will be performed by a contract team with subcontractors.

Contractor work starts with mobilization that includes locating their staff on-site, moving equipment on-site, site reviews of the job locations, planning and site preparations. To plan and prepare the site for removal of specific large components, the large component removal contractor will develop a detailed dismantling and removal schedule sequence, detailed work packages to support execution, engineering and rigging lift plans, and engineering design documents as appropriate.

Before removing each large component, it will be confirmed and independently verified that all hazardous and/or regulated materials associated with the component have either been remediated or abated and all electrical power supplies have been disconnected.

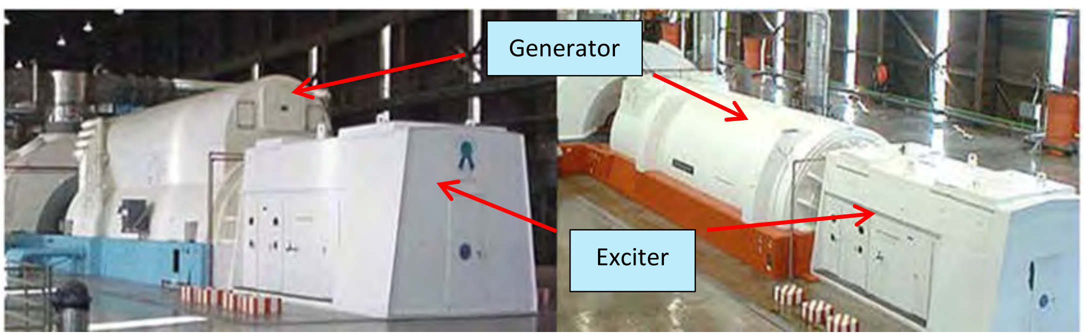
The contractor will perform all scaffold erection and/or teardown to support removal of interference and the component. The contractor will perform electrical and mechanical air gaping; remove all interferences around the large component or load path; remove all thermal insulation from the large component; and remove support structures for the large components. The specific details of these activities are described for each component.

A Specialty Contractor will be used for the heavy rigging, component movement/transportation, and thermal cutting, which require specialty designed tools and equipment. Industry experience has shown that for these work scope activities, the specialty contractors have a unique skill set and tooling capabilities. All heavy rigging will be performed in a controlled and pre-planned manner. An excavator fitted with a hydraulic shear and/or thermal cutting will be the primary way that most of the large components will be cut to manageable sizes.

The contractor will perform a sequence of activities for each of the large components to be removed before the Turbine Building is demolished. These activities include segmenting the large component in its current location in manageable size pieces; rigging the segmented portion of the large component using the turbine overhead crane to crane bay to be loaded onto a trailer or dump trailer; transporting the segmented piece of the large component to the designated staging area for further processing; and further downsizing and packaging segmented pieces, as required, for disposal purposes.

The LCR scope within the Turbine Building includes 16 components per unit. These components include the main exciter, main generator, one high pressure turbine assembly, three low pressure turbine assemblies, one main condenser, six moisture separator re-heaters and three feedwater heaters. The component size, weight, and configuration will determine the removal strategy.

Main Exciter and Generator: The main generator is a Westinghouse synchronous, alternating current, four-pole, 1800 RPM machine, with water cooled stators and hydrogen inner cooled rotors. They are rated for 75 psig hydrogen pressure. Both units are equipped with a shaft driven brushless exciter. The Unit 1 main generator is rated for 1300 MVA. The Unit 2 main generator is rated for 1340 MVA. Each of the generators is 48 ft. by 15 ft. and weighs approximately 550 tons fully assembled and is in the Turbine Building 140' elevation. The main generator consists of three major components -- the stator, the rotor, and the brushless exciter. The stator includes the stationary components in the generator, including the stator conductors, core, leads and frame. The rotating component of the generator is called the rotor. The cylindrical rotor is coupled to the shaft of the turbine. The rotor is mechanically driven or rotated by the main unit turbine, while it remains positioned within the bore of the stator. The rotor contains the field winding, which produces a magnetic field when energized with direct current. The purpose of the generator exciter is to furnish direct current to the rotating field of the rotor and provide a way to regulate the amount of current supplied.

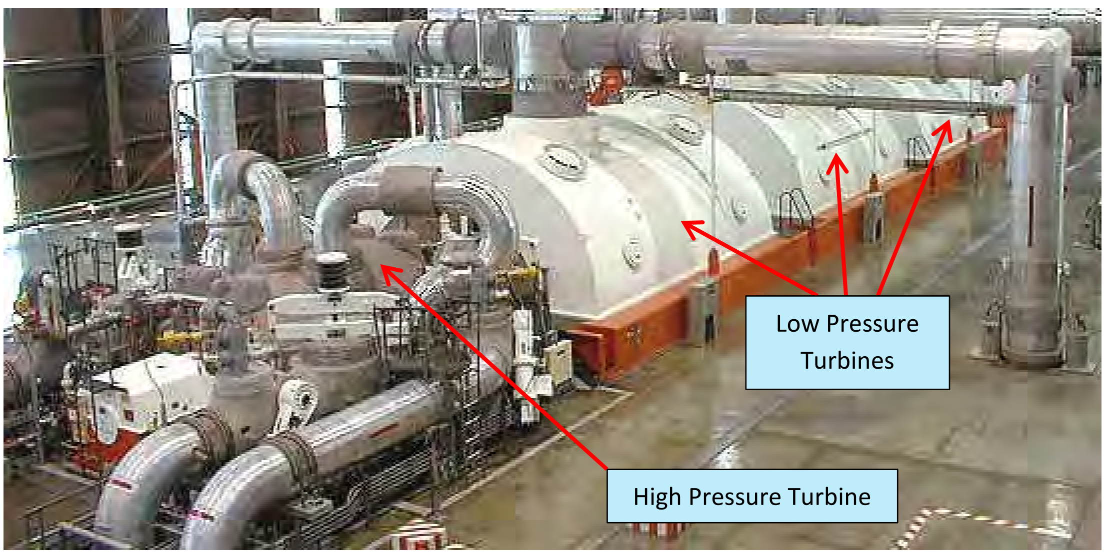


The main generator and exciter (Unit 1 on the right and Unit 2 on the left)

The main generator and exciter will be disassembled and segmented into manageable pieces. The pieces will be transferred from their existing location and lowered to the Turbine Building truck bay and set onto a trailer within an intermodal. The segmented pieces will be transported to the designated staging area for further processing.

High and Low-Pressure Turbine Assembly: Each unit consists of four individual turbines (one HP and three low pressure (LP) assemblies). All four turbines are connected by a common shaft and couplings that are supported by large slide bearings and are in the center of each unit's portion of the Turbine Building at the 140' elevation. The turbine operates at a speed of 1,800 revolutions per minute (rpm). The HP turbine rotor is machined from alloy steel forging weighing 55 tons. The HP turbines are

Westinghouse Model BB96, 7 stage turbines. The blades fit into grooves machined in the rotor. A separate stub shaft is bolted to the governor end of the rotor to drive the main oil pump. The high-pressure casing is a carbon steel cylinder that is split horizontally at the centerline to form a base and a cover that weighs 175 tons. Steam enters the casing at nozzle chambers that are in the middle of the casing through four lines that each contain a stop valve and a governor valve. The steam enters the high-pressure casing at the middle and flows outward in each direction through the blading to the exhaust openings in the turbine base and is directed to the moisture separator re-heaters (MSR). The LP turbines are Alstom Model LP56 rotors (with ND56R blading) with eight stages of dual-flow blading. The rotors are of the "welded-drum" design, manufactured by welding together individually forged and heat-treated discs of moderate size. The inner casing and installed blade carriers are split horizontally and held together with bolts. The high and low-pressure turbines are coupled using jackshafts to form a single shaft rotating assembly that is attached to the main generator.



Unit 1 High and Low-Pressure Turbines

The high-pressure steam piping and valves will be severed either by mechanical or thermal cutting from the HP turbine into manageable size pieces. The pieces will be transferred from their existing location and lowered to the Turbine Building crane bay and set onto a trailer within an intermodal. The segmented pieces will be transported to the designated staging area for further processing. After the pipes and valves are removed, the segmentation of the HP turbine will occur. The segmented pieces of the HP turbine will be transferred to the designated staging for further segmentation and processing in the same fashion. Segmentation of the LP turbines and related large components into manageable size pieces will occur in the same manner as the HP turbine assemblies.

Main Condenser: The main condenser housed within the Turbine Building and is located below the three LP turbines, starting at the 133' elevation and extending to the 73' elevation. The main condenser has an overall length of 129 ft. with each of the LP turbines exhausting into it. The main condenser is split into a north and south half with a tube bundle to cool the steam into condensate. The main condenser also houses extraction steam piping and feedwater heaters #5A/C and #6A/C. The main condenser, internal piping and feedwater heaters will be segmented into manageable pieces. The segmented pieces will be transferred to the designated staging area for further processing.

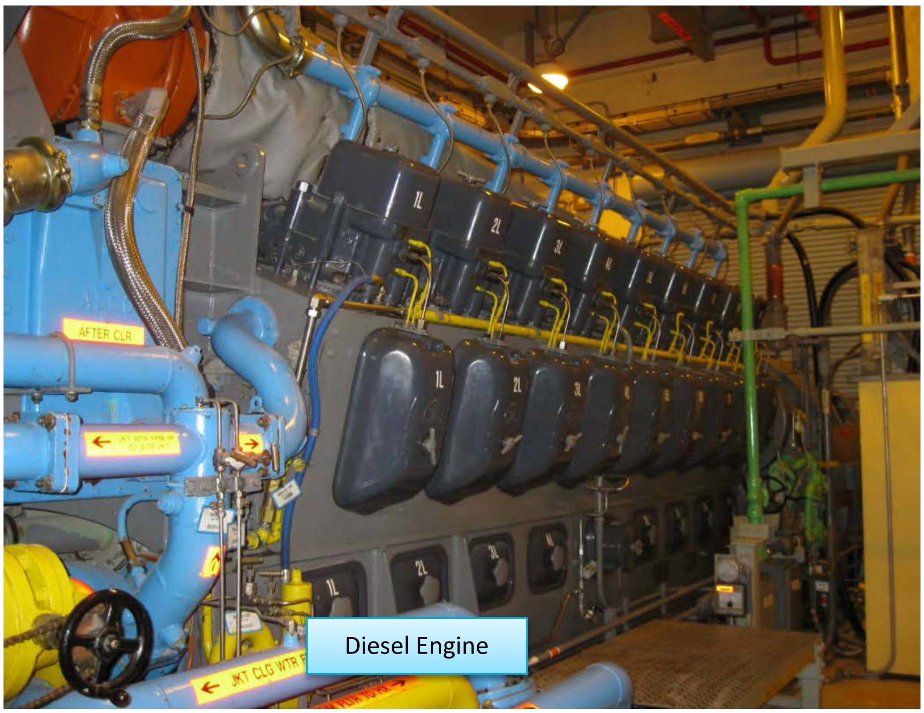
Moisture Separators: Each unit has six MSR located in the Turbine Building on the 119' elevation (three on each side of the main condenser). These large heat exchangers are approximately 45 ft. in length with a diameter of approximately 12 ft. The MSRs have heating tube bundles that superheat the HP turbine exhaust steam and remove moisture from the steam before it enters the LP turbines. The MSRs will be segmented by thermal cutting into manageable pieces. The segmented pieces will be transferred to the designated staging area for further processing.

Moisture Separator Reheater (left center of photo)

 # 2 Feed Water Heaters: Each unit has three #2 feedwater heaters located in the Turbine Building on the 119-foot elevation. The feedwater heater is approximately 40 ft. in length with a diameter of approximately 5 ft. The #2 feedwater heaters will be segmented by thermal cutting into manageable pieces. The segmented pieces will be transferred to the designated staging area for further processing.

Emergency Diesel Generators (EDG): Each unit has three emergency diesel generators; they are in the northwest corner of the Turbine Building for Unit 1 and the southwest corner of the Turbine Building for

Unit 2 at the 85' elevation. The EDGs are skid-mounted units in which the skid has been mounted in individual rooms by anchoring to the floor. The EDG engine, generator, and radiator assembly are all mounted on the skid; the skid has an overlength of 41 ft. and width of 10.5 ft. at a dry weight of 115,500 lbs. The diesel engines are air start, Alco, 900 rpm, V 18-cylinder, four stroke/ cycle turbo supercharged engines. Each engine's speed is controlled by an electrohydraulic governor. The generators themselves are rated continuous load rating of 2600 kW at 3250 kVA at 900 rpm, with a 0.8 power factor, generating three phases 4160 V at 60 Hz. The EDG supplies standby power to the 4160V Class 1E alternating current buses when power is unavailable from the off-site power sources or the main turbine generator units.



The EDGs will be air gapped mechanically and electrically prior to removal. The radiator and lube oil cooler, as well as the supporting auxiliary systems, will be disconnected and removed by mechanical means from the EDG engine and generator. It's desirable to remove each EDG as a complete unit, as described in the next few sentences. An access opening will be created by removing the structural steel on the west side of the room. The EDG skid anchorage will be mechanically removed. The skid will be placed on multi-ton rollers and pulled out of the existing room. After the EDG unit is removed from the building, it will be lifted by a mobile crane onto a vehicle, which will be transport it to the designated staging area for further disposal processing.

The remaining large components in the Turbine Building will be demolished and downsized in the same timeframe that the Turbine Building will be demolished. Best management practices, lessons learned, and now-current decommissioning industry standards support the position that there is no benefit to arbitrarily remove all systems and/or all large components before demolishing a structure.

4.1.1.6.3. Auxiliary Building

The Auxiliary Building is located between the Unit 1 and Unit 2 Containment Buildings. It contains the control room, electrical bus distribution, and site communications equipment. One-half of the Auxiliary Building is a mirror image of the other, with each half of the structure containing equipment for one Unit. The control room is located at elevation 140 ft. The only connections between the Auxiliary Building and other structures are the fuel transfer tube, miscellaneous piping, and attachments to the pipeway structure.

The Auxiliary Building contains equipment for the CVCS, Safety Injection systems, RHR systems, CCW systems, LRW systems, gaseous radioactive Waste system, and others.

The main floor levels in the Auxiliary Building are at elevations 85', 100', 115', and 140'. Elevations 55', 60', and 73' are below ground level, which is at elevation 85', except for the east side of the building where ground level is at elevation 115'. The foundation of the Auxiliary Building is divided between three elevations. The structure is supported at elevations 85' (Areas GE, GW, and L), 100' (Area J), and 60' (Areas H and K).

The Auxiliary Building is a reinforced concrete shear wall structure, except for the fuel handling area crane support structure, which is a structural steel moment resisting and braced frame structure supported on elevation 140' and extending up to elevation 188'. The shear walls and slabs of the Auxiliary Building are generally 2-ft. thick.

The Auxiliary Building houses the radwaste processing equipment as well as the reactor and SFP cleanup systems. All liquid and gaseous radwaste is processed in this facility. As a result, there are concentrated levels of contamination throughout the facility. Therefore, a significant amount of material, including equipment, components, and piping, will need to be removed from the Auxiliary Building.

In addition, equipment and piping that remain in the building and are above a prescribed contamination level will be treated with a fixative to lock down contamination. In some cases, additional engineered controls will be put in place to minimize contamination spread. Equipment and piping above the OAD prescribed contamination Category 2 level will be surgically removed before demolition.

Tanks in the Auxiliary Building with high concentrations of crud contamination are planned to be flushed, drained, and then removed surgically before building demolition or in conjunction with the exposure of the tanks during building demolition activities. The tanks will be accessed, shielding will be put in strategic locations, and then the tanks will be grouted to a depth determined suitable by RP to provide sufficient shielding for personnel protection to remove the tank whole, or to segment it into manageable pieces. For tanks removed whole, the inlet and outlet piping will be cut and capped to provide an intact boundary to prevent the spread of internal contamination.

Piping associated with highly contaminated systems also will be surgically removed from the Auxiliary Building. Contaminated piping remaining in the building will be treated with a fixative to lock down contamination or mechanically isolated. Other contaminated components remaining in the building also will be treated to lock down contamination.

The SAC work activities associated with the Auxiliary Building will be performed by an oversight team with subcontractors. The mobilization phase will include locating their staff on-site, moving equipment on-site, site review of the job locations, planning and site preparations.

The Auxiliary Building planning and site preparations will include the following:

1.) Prepare a dismantling and removal sequence for the Auxiliary Building. This includes an assessment of building contents to ensure that the appropriate components, sub systems, and associated radionuclides are removed during the building preparation phase to support open air demolition of the Auxiliary Building.
2.) Procure radioactive waste containers
3.) Develop detailed work packages for the execution
4.) Develop any engineered or rigging lift plans
5.) Develop any design documents that may be required to maintain the building's structural integrity during contaminated equipment removal

The sequence of operations for bulk Auxiliary Building demolition preparation and advanced surgical removal of contaminated components/systems is as follows:

1.) Confirm that all hazardous and/or regulated materials associated with the building and advanced removal components have either been remediated or abated
2.) Disconnect all electrical power supplies, with disconnection confirmed by a qualified independent third party
3.) Air gap, both electrically and mechanically
4.) Hot tap the system, tank, or vessel to drain all the liquid
5.) Remove all interferences
6.) Remove all thermal insulation either on the advanced removal components/systems or along proposed cut lines
7.) Remove all unnecessary support brackets, anchor bolts, bracing, etc.
8.) Encapsulate open ends of removed components/systems to limit spreading of internal contamination during removal from the Auxiliary Building and transport to the waste disposal container

The waste path out of the Auxiliary Building will be on the east side of the building at the 115' elevation. Rigging materials out of this area will be supported by building cranes, grating removal between floors, and roll-up doors. Access openings between the elevations in the Auxiliary Building provide vertical access to the 115' elevation for waste to be moved from the point of generation up and outside, where it will be transported to the waste processing area.

4.1.1.6.4. Fuel Handling Building

The Fuel Handling Building houses the spent fuel storage pools, spent fuel cooling systems, and other fuel movement support systems. Spent fuel cooling equipment, components, and piping, will be removed from the Auxiliary Building because of high concentrations of contamination. The SFP storage racks will be removed by SAC immediately after the last fuel has been transferred to dry cask storage and it has been verified that all special nuclear material has been accounted for and also placed into a spent fuel cask for safe storage. This inspection for special nuclear material ensures that any identified fuel debris, or similar material, has been safely placed in the last spent fuel cask before it is welded closed. The immediate removal of the spent fuel storage racks is required to minimize the time it will take to load and seal the last spent fuel cask. Last, the area of the Fuel Handling Building that contains Auxiliary Feedwater chemical injection equipment will be cleared of installed plant equipment to create vacant floor space for installation of SFPI equipment.

The Fuel Handling Building is a steel-framed structure anchored to the concrete Auxiliary Building. The Fuel Handling Building encloses the fuel handling areas of Unit 1 and Unit 2. The two fuel handling areas that contain the SFPs, fuel handling cranes, fuel racks, and related equipment are located on each side of the east end of the Auxiliary Building, with the top of the SFPs at elevation 140'.

The walls of the SFPs are 6 ft. thick except for local areas around the fuel transfer tubes. The foundation slabs under the SFPs have a minimum thickness of 5 ft. The SFP sides and bottoms are lined with stainless steel, 0.25-inches thick on the bottoms and 0.125-inches nominal thickness on the sides.

The 125-ton overhead crane in the Fuel Handling Building is equipped with restraints that prevent derailing from motions associated with an earthquake. Two movable partition walls are used in the Fuel Handling Building to allow the fuel handling area crane to transition from one unit to the other unit. The movable partition walls separate the Unit 1 and Unit 2 areas during fuel handling operations. Removable floor grating on each elevation of the Auxiliary Building allows use of the fuel handling area crane to hoist equipment from even the lowest elevation of the Auxiliary Building.

Preparation activities to demolish the Fuel Handling Building are restrained by the inability to begin work activities near the spent fuel stored in the SFP. Equipment in the Fuel Handling Building that supports SFP cooling will remain in service until all spent fuel decays to the point that it meets the acceptable heat load configuration for placement into a dry cask spent fuel canister and is transported to the ISFSI. Demolition of the Containment, Auxiliary, and Fuel Handling buildings for both units is constrained until spent fuel offload has completed and GTCC waste is on the ISFSI pad. This activity is forecast to be completed seven years after Unit 2 shutdown.

The SAC work activities associated with the fuel handling building will be performed by an oversight team with subcontractors. The mobilization phase will include locating their staff on-site, moving equipment on-site, site reviews of the job locations, planning and site preparations.

The Fuel Handling Building planning and site preparations will include the following:

1.) Prepare a dismantling and removal sequence for the fuel handling building
2.) Procure radioactive waste containers
3.) Develop detailed work packages for the execution
4.) Develop any engineered or rigging lift plans
5.) Develop any design documents that may be required to maintain the building's structural integrity during contaminated equipment removal

The sequence of operations that applies for fuel handling bulk building demolition preparation and advanced removal of contaminated components/systems is as follows:

1.) Confirm that all hazardous and/or regulated materials associated with the building and advanced removal components have either been remediated or abated
2.) Disconnect all electrical power supplies, with disconnection confirmed by a qualified independent third party
3.) Air gap, both electrically and mechanically
4.) Hot tap the system, tank, or vessel to drain all the liquid
5.) Remove all interferences
6.) Remove all thermal insulation either on the advanced removal components/systems or along proposed cut lines
7.) Remove all unnecessary support brackets, anchor bolts, bracing, etc.
8.) Encapsulate open ends of removed components/systems to limit spreading of internal contamination during removal from the Fuel Handling Building and transport to the waste disposal container

Removal of the SFP storage racks is costed in this plan and scheduled to support removal of SFP rack equipment at the end of each unit's fuel offload campaign to ensure no high activity level debris is left below the SFP racks; this debris may require placement in a dry cask storage container.

Fuel Handling Building wastes during the SACP work will be transported using covered waste bins on roller carts starting at the point of removal, and then moved to the access opening(s) found through the elevations of the Fuel Handling Building. The carts will be moved to the roll-up doors at the 115' elevation using the gantry or a staged set of portable cranes located near each elevation hatchway. At the 115' elevation, the waste bins will be loaded into the clean or contaminated waste containers (depending on the rad technician's initial assessment) provided by WOG. WOG will then transport the full containers to the waste processing area and restock empty containers in the approved WOG waste collection area in the building. Wastes also will be transported onto the 140' elevation across the breeze way to the large roll-up door if special handling is required.

The waste path out of the Fuel Handling Building will be on the east side at the 115' elevation. Rigging materials out of this area will be supported by building cranes, grating removal between floors, and roll-up doors. Access openings between the two SFP areas provide vertical access to the elevations in the building and allow waste to be moved from the point of generation, where it will be transported to the waste processing area. Outside access will be through the roll-up doors located at the 115' elevation.

4.1.1.6.5. Intake and Discharge

Intake and discharge areas will be prepared for demolition in the same manner as the other buildings and areas. Of particular note, the intake is expected to be a clean demolition.

The Intake Structure houses and supports components of the circulating water system, ASW system, bio-lab, and travel screening system components. Condenser cooling water for the plant is pumped from the Pacific Ocean and returned to the ocean at Diablo Cove through an outfall at the water's edge. The Pacific Ocean at the site is turbulent and has a great capacity for diluting wastes and diffusing heated cooling water. The east and west breakwater structures, built of precast concrete blocks and rip-rap, protect the Intake Structure from wave action and tsunami loads.

The ASW system within the Intake Structure must remain functional and intact to support SFPs' cooling until the SFPI system has been installed and placed into service. Installation of the SFPI system is described in Section 4.1.1.2.1, with an expected operational timeframe of 18 months after each unit is shut down.

The Intake Structure is a reinforced concrete building constructed with 3,000 psi minimum-specified-strength concrete. The structure is approximately 240 ft. by 100 ft. The long dimension corresponds to the north-south direction and is parallel to the seaward face of the structure. The Intake Structure is backfilled by rock on three sides and has water on the fourth (western) side. The top deck of the structure has a maximum elevation of +17.5' mean sea level. A concrete ventilation tower with steel coaxial ventilation pipe extends to an elevation of +49.4', which provides the cooling air associated with the auxiliary salt water watertight compartments (also referred to as the snorkels). The structure is supported by a concrete mat foundation at elevation (minus) -31.5'.

The top level of the structure consists of an 18-inch-thick concrete slab, except for the roadway area where it is 24 inches thick. Openings are provided to allow removal of pumps, screens, and gates. The pump deck floor at elevation -2.1' supports the four main circulating water pumps and the four auxiliary salt water pumps. The ASW equipment is in ventilated watertight compartments. The structure is symmetric about a vertical plane in the east-west direction through its centerline.

An evaluation of the Intake Structure did not identify any specific contaminated components/systems that need to be removed before it's demolished to avoid potentially contaminating other waste in surrounding areas. Therefore, all components/systems in the Intake Structure will be demolished and downsized at the same time that the Intake Structure will be demolished. Best management practices, lessons learned, and now-current decommissioning industry standards support the position that there is no cost benefit to arbitrarily remove all systems and/or all large components in advance of demolishing a structure.

The discharge of both units is connected to the liquid radwaste disposal system, which flows through the Discharge Structure, and has been used as a dilution source during plant operations. The liquid radwaste piping discharges into the ASW discharge piping embedded in the Turbine Building slab. The ASW discharge piping then continues to the Discharge Structure. The SACP activities will include the termination of the ASW piping within 10 ft. of the Turbine Building exterior. The ASW piping embedded in the Turbine Building foundation, as well as the remaining ASW piping leading to the discharge tunnels, is expected to have radiological contamination that may need to be remediated prior to or during demolition activities. The ASW Piping from the Turbine Building to the Discharge Structure will be removed as part of building demolition.

The SAC work activities associated with the Intake Structure will be performed by an oversight team with subcontractors. The mobilization phase will include locating their staff on-site, moving equipment on-site, site reviews of the job locations, planning, and site preparations.

The sequence of operations that applies for intake bulk building demolition preparation is as follows:

1.) Confirm that all hazardous and/or regulated materials associated with the building and advanced removal components have either been remediated or abated.
2.) Disconnect all electrical power supplies, with disconnection confirmed by a qualified independent third party
3.) Air gap, both electrically and mechanically
4.) Hot tap the system, tank, or vessel to drain all the liquid

4.1.1.6.6. Radwaste Buildings

Radwaste Buildings 117 A, B and C are located at the east end of the power block off the east roadway. Normal radwaste operating functions for all three buildings – including a radwaste laundry in Building 117A -- are required until all spent fuel and GTCC waste materials are relocated to the ISFSI. After that, the buildings will have dedicated areas to store particular types of bulk radwaste material, such as small-bore piping or contaminated concrete from removed equipment. Minor building modifications will be required.

Building 117A, for example, will be required to allow storage of equipment for the liquid radwaste system. And there will be open floor space in both Building 117A and Building 117C for bulk storage of radwaste materials during System and Area Closure for contaminated material that was in the Auxiliary and Containment Buildings.

After the three buildings are no longer needed, SAC will begin bulk and surgical preparation activities. Elevated concentrations of contamination exist throughout all three buildings, so a significant amount of the equipment, including processing equipment, components, and associated piping, will be surgically removed.

Preparations for demolishing the three buildings are similar to those used in the other contaminated buildings within the main PA. These buildings will be prepared for demolition and, in this case, most of the installed equipment will be surgically removed before demolition because of current radiological conditions and their history of interaction with contaminated radioactive materials. These buildings are particularly notable as a potential source of contamination because of their relatively small footprint, which provides a higher probability of contamination spread during demolition if the contaminated equipment is demolished with the buildings.

The SAC work activities associated with the laundry and radwaste buildings will be performed by a contract team with subcontractors. The mobilization phase will include locating their staff on-site, moving equipment on-site, site reviews of the job locations, planning, and site preparations.

The laundry and radwaste buildings' planning and site preparations will include the following:

1.) Prepare a dismantling and removal sequence for the three buildings
2.) Procure radioactive waste containers
3.) Develop detailed work packages for execution
4.) Develop any engineered or rigging lift plans
5.) Develop any design documents that may be required to maintain structural integrity of the buildings during contaminated equipment removal

The sequence of operations is as follows:

1.) Confirm that all hazardous and/or regulated materials associated with the buildings and advanced removal components have either been remediated or abated
2.) Disconnect all electrical power supplies, with disconnection confirmed by a qualified independent third party
3.) Air gap, both electrically and mechanically
4.) Hot tap the system, tank, or vessel to drain all the liquid
5.) Remove all interferences
6.) Remove all unnecessary support brackets, anchor bolts, bracing, etc.
7.) Encapsulate open ends of removed components/systems to limit spreading of internal contamination during removal from the buildings and transport to the waste disposal container

4.1.1.6.7. Balance of Site

The Auxiliary Boiler Enclosure (Building 118) is a metal-sided single-story enclosure located northeast of the Unit 1 Containment Building, outside of the RCA. The Auxiliary Boiler Enclosure components were used to provide steam during initial power plant startup but have been abandoned in place for many years because they are no longer required for normal plant operation and refueling.

The auxiliary boiler area is not expected to have radiological contamination according to survey maps and site observations. The SAC preparation for building demolition will perform the activities listed earlier, including removing of oil/diesel trapped in lubrication or fuel lines. Waste materials will be loaded into the waste containers and transferred to the WOG waste staging area.

The sequence of operations that applies for Auxiliary Boiler enclosure demolition preparation is as follows:

1.) Confirm that all hazardous and/or regulated materials associated with the building and advanced removal components have either been remediated or abated
2.) Disconnect all electrical power supplies, with disconnection confirmed by a qualified independent third party
3.) Air gap, both electrically and mechanically
4.) Hot tap the system, tank, or vessel to drain all the liquid

The Waste Handling and Treatment (WHAT) Facility (Building 307) is a metal sided single story enclosure located outside of the PA to the east, adjacent to the Raw Water Reservoirs. The WHAT Facility components were used to treat non-radiological water. Water processed at this facility may have undergone filtration, neutralization, or been chemical treated to bring the effluent to within acceptable limits for discharge. As a result, additional measures to abate the potentially hazardous materials contained in the three WHAT storage tanks immediately next to the WHAT building may be required.

The Waste Holding and Treatment building and area processed plant discharge water could be subject to mild contamination. The SAC Plan will use the post-shutdown characterization data to determine the extent of contamination located in the building, piping, and storage tanks. The preparation for demolition of the WHAT building/area will include manually removing any equipment determined to be contaminated. It is expected that the WHAT building and area can be demolished in a nonradioactive manner after the removal and remediation is performed. Likely targets for removal are the transfer piping, pump, and hold-up tank internal residual materials.

The sequence of operations that applies for the WHAT facility demolition preparation is as follows:

1.) Confirm that all hazardous and/or regulated materials associated with the building and components, including the three WHAT tanks, have either been remediated or abated in a manner to limit further spread of potentially hazardous contaminants
2.) Disconnect all electrical power supplies, with disconnection confirmed by a qualified independent third party
3.) Air gap, both electrically and mechanically
4.) Hot tap the system, tank, or vessel to drain all the liquid

<u>Large Component Removal Details – Balance of Site</u>

The OSGSF stores the SGs (also known as legacy SGs) removed from the Unit 1 and Unit 2 Containment Buildings as part of the DCPP SG Replacement Project. The OSGSF design includes additional areas to store the Unit 1 and Unit 2 reactor vessel heads assemblies (also known as legacy reactor vessel heads).

The OSGSF is located on the DCPP site within the OCA and outside the PAs and the coastal zone. This scope of work is limited to the disposition of these eight additional SG units and two reactor heads. A temporary tensioned membrane building will be constructed for segmenting legacy components with a high efficiency particulate air filtered system. To lift and support these components, temporary gantry cranes will be erected near the OSGSF and temporary building. All this equipment will be used later when the existing Category 1 components are removed from the Containment Buildings.

Legacy Reactor Heads: The legacy reactor heads are stored horizontally in a cradle that is mounted to the floor and welded to embed steel plate in each storage vault in the north side of the OSGSF. Each of the legacy reactor heads has a seal plate bolted to the flange area. To gain access to the storage vault for the retired reactor heads, the contractor will need to remove heavy concrete wall segments. These concrete wall segments will be rigged using a mobile crane and place in a staging area. A temporary RCA will be established near the OSGSF to segment the reactor head.

The cradle to embed welds will be removed by grinding and the cradle will be re-positioned or moved to the temporary RCA to prepare the reactor head for further segmentation. The reactor head will be removed from the cradle and placed on stands. The cradle will be segmented into manageable size pieces and placed into waste containers. These waste containers will be transported to the on-site waste staging area for further processing and shipment to an out-of-state disposal site. The reactor vessel closure head will be segmented to an "oversize debris" disposal specification in lieu of transporting the closure head unit ("large component"). This will reduce the cost of transportation and disposal. All the segmented pieces of the closure head will be shipped in either intermodals or gondola cars to an out-of-state disposal facility.

Legacy Reactor Head in storage at the OSGSF

Legacy Steam Generators: Four Westinghouse model 51 SGs are stored in each storage bay in the OSGSF. These SGs were replaced in 2008/2009 respective outages. The SGs will be removed from OSGSF in two large sections -- the steam dome section, and the lower shell section. The lower shell section consists of the channel head with primary nozzles, U-tubes with tube sheet and wrapper barrel. A temporary RCA will be established next to the storage bay. This temporary RCA will be the area where the SGs will be segmented into two pieces.

The contractor will fabricate additional saddles to be placed under the two sections of the SGs. The saddles will be designed and fabricated for two different diameters. One SG at a time will be removed from the vault for segmenting. The SG will be moved using a SPMT out of the storage bay; once removed, a second set of saddles will be placed under both the steam dome and lower shell sections. The SG will be moved into the temporary RCA, and the segmentation tooling will be attached to the SG shell at the upper transition piece. The segmentation tooling will be a track-mounted thermal cutter. The steam dome will be thermally cut at the top of the transition cone, the seal plate will be welded on, and prepared for rigging using a temporary gantry crane. The steam dome will be placed on a SPMT and transferred to a nearby on-site processing area for further packaging. A seal plate will be welded onto the lower section at the top of the transition cone to seal off the lower shell. This plate will be designed as radiation shielding. When this stage has been completed, the lower shell of the SG will be transferred out of temporary RCA onto a SPMT and moved to a nearby on-site processing area. The remaining SGs will be removed using the same technique. Once the lower shell section is at the SG processing area, final preparations as Class A radioactive waste will be completed. Package preparation activities as specified in 10 CFR 71 and DOT regulations include installing radiation shielding (of sufficient thickness to meet DOT transportation requirements) around the exterior of the primary side; decontaminating and coating the exterior with a fixative to achieve contamination limits specified in 10 CFR 71 and DOT regulations; and injecting LDCC into the primary side and secondary side voids to fix loose surface contamination.

Each of the SG's sections will be placed and secured onto a transportation cradle, compatible with an overland transporter. Each SG section will then be loaded onto a multi-wheeled transport vehicle and transported to an out-of-state disposal facility. The SG sections will travel through California, Nevada and Utah with the appropriate state or local authorities escorting the shipment. The escorts are mainly used for traffic control; however, a support team also will travel with this shipment to move any interferences (road signs, lift wires, etc.). The transportation contractor will secure all the necessary permits and coordinate with the state/local agencies for transporting the SGs to the disposal site.

Old Unit 1 steam generators in their long-term OSGSF

4.1.1.7. Waste Transportation and Disposal

The total cost of waste transportation and disposal during the license termination phase is provided in Table 4-1.

4.1.1.7.1. Waste and Transportation Management

Waste Management

Decommissioning generates a significant quantity of waste that impacts decommissioning costs and schedule. Responsible individuals need to be versed in radioactive waste management and packaging, hazardous waste management and packaging, radioactive waste requirements, as well as hazardous and clean waste requirements, in order to:

- Analyze and forecast waste volumes and types
- Assess on-site management options
- Assess packaging, transportation and disposal options

Moving waste material from DCPP to storage or disposal locations is costly, labor intensive, and highly regulated. Radioactive or chemically hazardous wastes present risks that must be understood and managed. Proper planning can help ensure that inefficiencies are removed and that risks are identified and mitigated. The Waste Management and Disposal Plan defines the waste handling and disposal requirements, responsibilities, and activities required to prepare radiological and non-radiological waste from the point of generation to off-site shipment and disposal.

Management of waste and transportation activities will be critical to ensure a successful decommissioning. PG&E will establish a WOG to ensure efficient site operations, with team members well versed in Radioactive Waste, Hazardous Waste, mixed and clean waste. The team provides a robust source of talent for oversight of waste management practices at DCPP, the packaging of waste materials for disposal, and preparation of required shipping papers and notifications when waste material is shipped out. These responsibilities span the requirements of federal and state Hazardous Waste Management regulations, the Federal Toxic Substances Control Act, NRC waste management regulations, and federal and state highway transportation regulations.

The WOG is responsible for coordinating on-site waste transportation, treatment, and disposal with vendors; reviewing and approving shipping papers for waste shipments; evaluating securement practices for waste shipments; completing waste disposal permits and reports for regional waste disposal compacts and hazardous waste management reporting; and maintaining updates to the California Hazardous Materials Business Plan. Each year, this team obtains export permits from the Southwest Low-Level Radioactive Waste Compact, for radioactive waste leaving California.

As waste material is generated during decommissioning, waste management personnel will coordinate with work crews and waste handling personnel to ensure waste materials are efficiently packaged for disposal. This includes planning and oversight to ensure that container weights and volumes are optimized to minimize the total number of waste shipments and to ensure that waste packaging is aligned with disposal facility acceptance criteria to avoid non-conforming shipments and additional fees. In addition, waste management personnel will ensure the continued movement of waste materials from the DCPP site because an excessive backlog of waste material on site could force a suspension of decommissioning activities. Other activities that the Waste Owners Group are responsible for include:

Intermodal Route (Flow Path)

There is an established route for intermodals on site. Incoming trucks are radiologically surveyed to ensure that they are clean. Their cargo intermodals undergo an incoming radiological survey, are logged and recorded. The intermodal is inspected for physical damage, logged, repaired if required, staged on site, and annotated ready to load. The intermodals are loaded with appropriate content and inventory logs are completed. The filled intermodals are weighed with weights recorded. The loaded intermodals are radiologically surveyed, with the shipper recording the survey number, labeled with content and weight and staged for off-site shipment. On the scheduled departure day, the intermodal is inspected for securement to the truck and final markings. The truck is radiologically surveyed on its exit from the site.

On-site Movement of Containers

To handle increased truck traffic during busy shipping periods, the traffic flow pattern must obey strict safety guidelines, while efficiently moving material through the plant. Containers that are considered hazardous are staged for loading outside the busy areas or in a posted restricted area. Nonradioactive waste is staged and loaded onto trucks in a more convenient location, possibly in front of the Waste Management Facility (WMF).

The safe and environmentally sound transfer of waste from the point of generation to a designated staging area is one of the most important activities in preventing the spread of contamination. Having dedicated equipment in both the contamination zone and the clean area avoids cross-contamination and prevents radioactive material from entering uncontrolled areas. Cross-contamination and radioactive material in uncontrolled areas can increase costs and cause regulatory issues.

Waste materials and reuse materials are used on-site in inspected and approved transport vehicles and containers. Transport vehicles moving from an excavation are cleared of loose dirt or debris and must be released by Radiological Protection before being allowed to exit a radiologically controlled area.

Waste materials not direct loaded at the point of generation or that require additional handling and packaging may be transferred to a location such as the WMF or an alternative approved location, using appropriate containers such as an end dump, dewatering bags, or super sacks. Further handling and packaging of waste materials is performed by qualified personnel until the waste is acceptable for transport to the off-site facility.

A majority of the waste will be sent out in intermodals, but there are other standard package configurations, specialty packages, oversized containers, or unusual shipping configurations. The WOG includes the labor, equipment, and supervision to deliver, unload, move, manipulate, and reload waste packages. It also includes preventive and corrective maintenance of the intermodals. In addition, it includes labor to load demolition debris into the shipping containers (for non-direct loading) and the planning, characterization, radiological surveys, and logistical support services necessary to execute the radiological and mixed-waste packaging and transportation function for nuclear decommissioning.

Container Optimization

The WOG is tasked with ensuring that the waste containers leaving the site are filled as efficiently as possible to minimize the number of loads leaving the site. The required number of waste containers for DCPP is based on the following:

1.) The Transportation Plan, which determines the turnaround time for reusable containers from the time the container leaves the site for a disposal facility until the time it returns to the site for further duty.
2.) The waste material’s classification, which determines waste disposal volumes. For example:
    - ☐ A container loaded with concrete rubble is typically limited by weight rather than capacity
    - ☐ A container loaded with ferrous materials is typically limited by capacity rather than weight

Packaging and container strategies have been developed in the Transportation Plan to meet the following key objectives:

- Maximize payload
- Minimize the total number of off-site shipments
- Maximize disposal efficiencies
- Provide the most economical packaging that meets regulatory requirements
- Safe, efficient, and economical truck-to-rail transfer for large volumes of “clean,” non-detect waste and LARW
- Minimize container purchase and repair costs

These objectives are accomplished through the following ways:

- Use of steel intermodal containers for transport of “clean,” non-detect waste and LARW debris from the DCPP site to the final disposal location through the Pismo Beach railyard truck-to-rail transfer station.
- Use of soft-sided bags meeting industrial package (IP)-1 and IP-2 criteria to the maximum extent possible over disposable steel containers; this provides significant cost savings to the project.
- Repair and reuse of steel intermodal containers, using the DCPP site cold machine shop for container repair, as required.

Table 4-14 below indicates the number of waste containers required to support DCPP decommissioning. It should be noted that the information in Table 4-14 does not include the weight of the concrete rubble that will be repurposed on-site as backfill media by the Material Management Group. The backfill media does not require any sort or form of waste container because the material will be trucked on-site from the crushing and screening facility in Parking Lot 7 to the site where the backfill will be placed.

Table 4-14: Waste Container Requirements

Waste Class	Material	Weight (Tons)	Container Type	Required Number of Containers
Non-detect	Recyclable Metal	72,281	Intermodal liner	3,614
	Recyclable Concrete and Asphalt	87,887	Truck liner	4,394
	Out-of-State Disposal	794,000	IP-1 "tippable" bag for intermodals	39,700
LARW,	Metal	55,098	Intermodal liner	2,755

Waste Class	Material	Weight (Tons)	Container Type	Required Number of Containers
10 CFR 20.2002	Concrete	176,287	IP-1 "tippable" bag for intermodals	8,814
Class A LLRW	Metal	26,089	Intermodal liner	1,304
	Concrete	103,821	IP-1 "tippable" bag for intermodals	5,191
Class B/C		48	8-120 liner	9
Other Regulated Debris	Soil, Asbestos, etc.	34,263	Truck liner	1,713
	TOTAL	**1,350,796**		
General Purpose Containers				
Steel Intermodals			75 for Period 2; 125 for Period 3	
Drums, B-25 boxes, etc.			500	

Reusable Waste Containers

The intermodal containers described in previous sections are all reusable, as are cargo containers. Those types of containers will be repaired as necessary at the DCPP site Cold Machine Shop and reused during the project. It should be noted that at the end of the project, those containers may have residual sale value if they can be cleaned to free release radiological requirements (i.e., no discernable activity above background radiation).

Soft-sided containers such as bags, and all small containers such as drums and B-25 boxes are not reusable. These types of non-reusable containers will be disposed of along with the waste in the containers.

Total Waste Volumes

Table 4-15 shows the various waste volumes that will be generated during DCPP's decommissioning that the WOG will need to manage.

Table 4-15: Waste Classifications and Accompanying Weights

Waste Type/Classification	Weight (Tons)
Asbestos-Containing Materials	
Non-detect Galbestos Sheeting	855
Non-detect Insulation, Gaskets, and Roofing Materials	118
Contaminated Insulation, Gaskets, and Wiring	339
Non-detect Concrete Rubble Repurposed On-Site as Backfill Media	347,610
Non-detect Concrete and Asphalt Recycled Out-of-State	87,887
Non-detect Ferrous and Non-ferrous Metal Recycled Out-of-State	72,281
Non-detect Lead Disposed of Out-of-State	16,700
Non-detect Concrete, Asphalt, and General Debris Disposed of Out-of-State	794,000
LARW, 10 CFR 20.2002	231,385
LLRW	
Class A LLRW	95,611
Class A DAW	6,496
Class B/C LLRW	48
Polychlorinated Biphenyl Laden Transformer Oil	18
Radiologically Contaminated Soil and Soil-like Materials (Class A LLRW)	26,610
Treated Wood Wastes (Non-detect debris)	75
Other Regulated Materials	17,427

Table 4-16 takes the total waste volumes and divides it by defined periods. The four periods are defined as follows:

- Period 1 begins three months after the shutdown of Unit 2 and ends when the final fuel off-loading campaign has been completed and the PAs have been reduced to an ISFSI-only footprint.
- Period 2 begins with the start of the demolition of the power block structures and ends when all the power block structures have been demolished and the demolition debris has been transitioned off-site.
- Period 3 begins with the start of the demolition of the Breakwaters and ends when the site has been restored by the Final Site Restoration Group.
- Period 4 begins when the spent fuel has been transferred to the DOE and ends when the former ISFSI site has been restored.

Table 4-16: DCPP's Decommissioning Waste Generation by Period (in Tons)

Waste Classification	Period 1	Period 2	Period 3	Period 4	TOTALS
Non-Detect Out-of-State Recyclables	16,470	61,564	75,243	6,891	160,168
Non-Detect Out-of-State Disposal	86,539	9,865	694,097	3,500	794,000
10 CFR 20.2002 LARW	664	230,721	-	-	231,385
Class A LLRW	4,238	99,062	25,800	810	129,910
Class B/C LLRW	545	525	-	-	1,070
Other Regulated Waste	74	1,541	15,948	16,700	34,263
TOTAL WASTE PER PERIOD	108,530	403,278	811,087	27,901	1,350,796
Non-Detect Concrete Rubble that is being Repurposed On-Site as Backfill Media by the Materials Management Group's Personnel					
Waste Classification	**Period 1**	**Period 2**	**Period 3**	**Period 4**	**TOTALS**
Non-Detect Concrete Rubble	-0-	288,800	-0-	58,810	347,610
TOTAL DECOMMISSIONING WASTE STREAM[10]					**1,774,216**

Transportation Management

A successful nuclear decommissioning project requires the mass movement of waste and debris off-site in a safe, timely, well-organized, and cost-effective manner to the designated disposal facility. The transportation activities begin after the waste is loaded on-site onto either a transport truck or a specialty carrier and ends when the waste container is offloaded at the disposal site.

Waste transportation also includes programmatic oversight required to implement and manage the transportation activities as well as all required documentation to support this scope of work.

It should be noted that all waste items that are identified in the Large Component Removal Plan and LLRW generated during the segmentation of the reactor vessel's internals and reactor vessels are excluded from this section due to scopes covering the transportation and disposal of those respective waste volumes. Those scopes of work are covered in Sections 4.1.1.4 and 4.1.1.6, respectfully.

[10] Total volume listed does not include waste from Large Component Removal or Reactor Pressure Vessel and Internals segmentation.

The transportation of most of the waste generated by the decommissioning of the DCPP's site is managed, supervised, and staffed by the Transportation Group (TG). The TG is responsible for the following activities:

1.) The activities required to transport waste[11] generated by the decommissioning of the DCPP site to a regulatory compliant disposal facility.
2.) Establishment and operation of an on-site container loading and marshalling area.
3.) Establishment and use of on-site transportation options and routes.
4.) The transportation of all the various decommissioning waste to a regulatory compliant disposal facility including, but not limited to, the following types of waste:
    - ☐ LLRW
    - ☐ Mixed radioactive waste
    - ☐ Radiologically contaminated water
    - ☐ Dry activated waste
    - ☐ Radiologically contaminated soil and soil-like materials
    - ☐ Asbestos waste
    - ☐ Lead waste
    - ☐ Universal waste
    - ☐ Any waste containing polychlorinated biphenyls
    - ☐ Treated wood wastes
    - ☐ Non-detect concrete
    - ☐ Non-detect ferrous and non-ferrous metal
    - ☐ Non-detect general debris
5.) Management of equipment resources required to transition the decommissioning project's waste from the DCPP's site to the designated waste disposal facility.

Waste Transportation Options

Except for some of the large components and other material, a majority of the waste generated during decommissioning will be transported in the same manner. Several options for transporting most of the waste from the site to a designated waste facility were evaluated. Four options were shortlisted for further study and evaluation:

1.) Transporting the waste in a soft-sided liner within an intermodal from the DCPP site to the Pismo Beach Railyard, then transferring the waste liner into a gondola railcar, which would transport the waste to the designated waste disposal facility via rail.
2.) A second truck-to-rail transport option entails loading waste directly into an intermodal with the TG's personnel moving the loaded intermodal from the DCPP site to the Pismo Beach Railyard.

[11] TG responsibilities do not include waste streams from Category 1 Large Component Removal or Reactor Vessel and Internal segmentation.

There, the intermodal would be transferred and positioned onto a flatcar, which would transport the waste to the designated waste disposal facility via rail.

3.) Transporting waste from the DCPP site in various types of shipping containers (e.g., intermodals, B-25 boxes, soft-sided bags, etc.) to the designated waste disposal facility over the road using trucks.
4.) Transporting waste by loading it into a barge at the DCPP site, then transporting it to the Columbia River. It would be unloaded at Boardman, Oregon for disposal at one of three possible regional solid waste facilities in the Columbia Gorge.

After completing the evaluations, Option 1 was selected for this detailed cost estimate. Options 2 and 3 were not chosen due to either the increase in rail cars that would be needed (Option 2) or the large volumes of truck required (Option 3), resulting in higher costs and other negative impacts. Barging (Option 4) was found in some cases (breakwater waste) to be a cost-effective option but the regulatory uncertainty in being able to use waterway transport eliminated it from consideration at this time.

Option 1 consists of transporting most of the decommissioning waste via truck to the PG&E-owned Pismo Beach Railyard at 800 Price Canyon Road; transferring the waste into a gondola (open-topped) railcar; and then shipping the waste to the destination disposal facility via rail. Some of the waste can't be shipped in gondola railcars. Intermodals, for instance, will be used to ship some ferrous scrap that is not conducive to being shipped in a gondola railcar because the metal has extremely jagged and sharp edges, is badly twisted and distorted, etc. Liquid radioactive waste will be transported over-the-road by truck.

Positive Aspects of Option 1

- Requires a minimal amount of long-distance truck travel time to disposal facilities

Transporting of waste via rail versus over-the-road semi-trailer trucks also is significantly safer, as shown in Table 4-17.

Table 4-17: Truck Transport versus Rail Transport Safety

Fatalities	2013	Annual Growth Rate 2000 to 2013 (percent)
Truck fatalities	3,964	-2.2
Railroad fatalities	509	-2.6
Waterborne fatalities	25	-3.9
Pipeline fatalities	9	-10.5
Total freight fatalities	***4,507***	***-2.3***
Truck fatalities/ billion ton-miles	1.375	-3.6
Railroad fatalities/ billion ton-miles	0.278	-3.7
Waterborne fatalities/ billion ton-miles	0.050	-2.0
Pipeline fatalities/ billion ton-miles	0.008	-11.1
Total fatalities/ billion ton-miles	***0.717***	***-3.2***

Injuries	2013	Annual Growth Rate 2000 to 2013 (percent)
Truck injuries	95,000	-2.9
Railroad injuries	3,977	-5.1
Waterborne injuries	100	4.7
Pipeline injuries	45	-4.4
Total freight injuries	***99,122***	***-3.0***
Truck injuries / billion ton-miles	32,953	-4.4
Railroad injuries / billion ton-miles	2.172	-6.2
Waterborne injuries / billion ton-miles	0.199	6.8
Pipeline injuries / billion ton-miles	0.042	-5.1
Total* injuries / *billion ton-miles	***15.779***	***-3.9***

- Reduces highway miles and improves safety because rail shipment is statistically safer than by truck
- Provides the most economical way to transport large volumes of non-detect and very low activity waste
- Greatly reduces the number of overall waste shipments over the road compared to Options 2 and 3
- The Pismo Beach Railyard was originally built for DCPP’s construction and has 1,100 ft. of existing rail siding which will be augmented with an additional 3,100 ft. of new rail spur track to handle the transportation requirements for DCPP’s waste.

Additional evaluations were performed to determine the appropriate way to transport waste from the DCPP site to the Pismo Beach Railyard; all are related to some variation of a “drop-and-hook” truck transit. The drop-and-hook option of choice is the scenario where:

Trailers are loaded with waste, staged and ready to ship from the DCPP’s site to the Pismo Beach Railyard. All shipping weights have been verified, the proper manifests or Bills of Lading (BOL) have been prepared and completed, and all requisite inspections have been completed. In other words, the trailers are prepared to depart from the DCPP’s site.

After unloading, the empty trailers are staged and ready to return to the DCPP's site from the Pismo Beach Railyard.

The truck driver simply hooks onto the loaded trailer, follows an established protocol for checking the manifest and/or BOL, makes the required pre-trip inspection, and then proceeds to the Pismo Beach Railyard.

This process contrasts with either a "live load" or "live unload" operation. In a live load scenario, the truck driver arrives at the loading site pulling an empty trailer and waits while the following occurs:

- A loaded container is placed on the trailer and secured
- Either a manifest and/or BOL is prepared and completed
- The truck is weighed
- The manifest and/or BOL is signed
- Radiological surveys, if required are completed

After those steps have been completed, the truck is cleared to leave the loading site.

A drop-and-hook transfer program is efficient and is an industry-preferred transfer method when compared to a live load or a live unload transfer operation; it has been used successfully by PG&E at HBPP for over 3,000 off-site radioactive waste shipments.

The drop-and-hook option was preferred in the scenario where the waste leaves the DCPP site in the evening, minimizing the need for a dedicated traffic control implementation plan and significantly reducing negative impacts upon the residential communities through which the waste would be trucked. Leaving the DCPP site in the evening also should be less disruptive to local traffic by avoiding peak periods of the day.

The evening drop-and-hook transfer scenario would require the empty intermodals at the DCPP site to be loaded with waste material by the WOG during normal daytime working hours and the loaded intermodals emptied at the Pismo Beach Railyard by the TG during the same timeframe.

<u>Transportation Option Durations</u>

<u>Rail Service</u>

The turnaround time for waste shipped via rail is generally 30 to 45 days. In other words, a gondola railcar or a rail flatcar with intermodals loaded with non-detect or LLRW should leave the Pismo Beach Railyard, go to the designated disposal facility, and return within 45 days.

<u>Truck Service</u>

Truck transit distances and driving times are shown in Table 4-18.

Table 4-18: Transit Times to Disposal Facilities

Disposal Facility	Distance in Miles	Driving Time in Hours
Energy*Solutions*, Clive, Utah	870	18
Republic Services' ECDC, East Carbon, Utah	850	18
US Ecology Nevada, Beatty, Nevada	468	8
La Paz County Landfill, Parker, Arizona	450	8
US Ecology Idaho, Grand View, Idaho	870	18
Waste Control Specialists, Andrews, Texas	1,810	33

4.1.1.7.2. Solid Radioactive Waste

Solid Radioactive Waste and Disposal

Low-Level Radioactive Waste is classified according to its radiological hazard. Two factors must be considered in determining the classification of radioactive waste. First, consideration must be given to the concentration of long-lived radionuclides (and their shorter-lived precursors) whose potential hazard will remain long after such precautions as institutional controls, improved waste form, and deeper disposal have ceased to be effective. These precautions delay the time when long-lived radionuclides could cause exposures. In addition, the magnitude of the potential dose is limited by the concentration and availability of the radionuclide at the time of exposure. Second, consideration must be given to the concentration of shorter-lived radionuclides for which requirements on institutional controls, waste form, and disposal methods are effective. As the waste class and associated hazard increase, the regulations established by the NRC have progressively greater controls to protect the health and safety of the public and the environment.

The classifications of Low-Level Waste are:

- Class A: Class A waste is the least hazardous and accounts for 96 percent of all low-level waste generated. Class A waste is usually segregated from other waste classes at the disposal site. The radioactive content of Class A waste must meet the limits of 10 CFR 61.55 (Waste Classification), and the physical form and characteristics must meet the minimum requirements of 10 CFR 61.56(a).
- Class B: Class B waste is allowed to have more radioactive content as limited by 10 CFR 61.55, but the physical form and characteristics must meet all requirements set forth in 10 CFR 61.56(a) and also meet the stability requirements of 10 CFR 61.56(b) to ensure stability after disposal.

- Class C: Class C is the most hazardous of the low-level wastes due to typically higher concentrations of much longer lived radioactive isotopic species. The radioactive content limits of 10 CFR 61.55 must be met along with all physical form and characteristics and stability requirements of 10 CFR 61.56.
- GTCC: This category of low-level waste is used to describe radioactive waste that is not generally acceptable for near-surface disposal and in which the radionuclide content exceeds the limits on radioactive content set forth in 10 CFR 61.55 for Class C waste. GTCC waste will remain within the DCPP ISFSI; all associated costs for disposing of GTCC wastes are described in Section 4.1.1.5.

California is part of the Southwest compact along with Arizona, North Dakota, and South Dakota. Since there is no radioactive waste disposal site in any of these states, radioactive wastes created by generators in the Southwest compact must be sent to another state that has a radioactive waste repository. There are currently four active NRC-licensed Low-Level Waste disposal facilities.

The four low-level waste disposal facilities are EnergySolutions Barnwell Operations in Barnwell, South Carolina; US Ecology in Richland, Washington; EnergySolutions Clive Operations in Clive, Utah; and Waste Control Specialists LLC, near Andrews, Texas.

Two of these sites won’t accept DCPP’s wastes. The Barnwell site accepts waste only from the Atlantic compact states (Connecticut, New Jersey, and South Carolina). The Richland site accepts waste from the Northwest and Rocky Mountain compacts.

The two sites that may accept waste from DCPP are described below.

The site in Clive, Utah, which accepts Class A waste from all regions of the United States, was started in the late 1970s when the DOE and the state of Utah began cleanup of an abandoned uranium mill site. It is in Utah’s West Desert approximately 75 miles west of Salt Lake City. Its remote location, low precipitation, naturally poor groundwater, and low-permeability clay soils make it attractive for radioactive waste disposal. The site uses an above-ground engineered disposal cell that provides a long-term disposal solution.

The site in Andrews, Texas accepts Class A, B, and C waste from generators in the Texas Compact and other generators outside the Texas compact with permission from the state of Texas and the Texas Compact. The site is a fully licensed 1,338-acre facility located on 14,900 acres in western Andrews County. It is located within a 1,200-ft. thick, nearly impermeable, red-bed clay formation. The site ensures safe and permanent disposal of radioactive waste by combining this unique natural barrier with a custom-designed and engineered 7-ft. thick, steel-reinforced concrete liner system.

Class B and Class C LLRW are virtually indistinguishable from one another from a disposal perspective. Both waste classes are loaded into a liner, and the liner is placed into a shielded shipping cask. The shipping cask is fitted with impact limiters and mechanical restraints to preclude the cask from falling off the transport vehicle and splitting open if an accident were to occur. The cask is then transported from the DCPP site to the WCS disposal facility.

All radioactive wastes that meet the requirements of 10 CFR 61 as Class A waste will be destined for the selected disposal site (e.g., Clive, Utah). PG&E strives to minimize the quantity of Class A waste requiring disposal. When disposal is required PG&E will select the disposal option with the best value. All radioactive wastes that meet the requirements of 10 CFR 61 as Class B or Class C waste will be disposed of at the Andrews, Texas site.

Materials that exhibit minimal detectable activity, where the level does not cross the lower threshold of Class A waste definition parameters, will be disposed of as 10 CFR 20.2002 waste. It must be noted that although 10 CFR 20.2002 waste is radioactive waste, it is not LLRW. Very Low-Level Waste (VLLW), or LARW, are radioactive wastes in which the radioactive content is a small fraction of the Class A limits contained in 10 CFR 61, and for which the extensive controls in 10 CFR 61 are not needed to ensure protection of public health, safety, and the environment. 10 CFR 20.2002 provides an alternative, safe, risk-informed disposal method for these materials. These materials can be disposed of in a licensed low-level radioactive waste facility; however, disposal using the relief provided under 10 CFR 20.2002 may significantly reduce transportation distances (often 1,000 to 2,000 miles), increase disposal options, and lower disposal costs, while still protecting public health and safety and the environment.

10 CFR 20.2002 waste should not be referred to as any of the following:

A. Below Class A waste
B. Low Class A waste
C. Class A exempt waste

10 CFR 20.2002 waste is neither affiliated with, nor associated with, Class A LLRW. Any reference to 10 CFR 20.2002 waste with a Class A designator is neither appropriate nor proper.

Again, although 10 CFR 20.2002 waste is radioactive waste, it is not disposed of as radioactive waste; it is deposited into a waste cell that is authorized to receive the classes of waste created by the RCRA, which was the public law that created the framework for the proper management of hazardous and nonhazardous solid waste.

Some nuclear decommissioning plants have submitted exemption requests to the NRC, in accordance with 10 CFR 20.2002, for alternate disposal of exempted waste at a RCRA hazardous waste site such as the one operated by US Ecology Idaho (USEI). This option is considered in the public's interest because it conserves low-level radioactive waste disposal capacity and is more cost effective. Acceptable waste includes low-level radioactive waste typically with less than 10 percent of the 10 CFR 61.55 limits for Class A waste and non-nuclear decommissioning debris or water.

Dose modeling and assessments, as well as sampling and analyses, will be performed to quantify the resulting dose impact to workers and the public. In addition, criticality assessments will be performed to demonstrate subcriticality of special nuclear material under expected disposal conditions. Concurrent exemption requests, in accordance with 10 CFR 30.11 and 10 CFR 70.17, will be required to be submitted and approved to allow a RCRA hazardous waste site to accept this waste. NRC approvals of these exemption requests have historically been based on the conclusion that the dose impact to workers and the public would be no more than a few millirem (mrem) per year for the waste, source term, and quantities of material to be shipped to the disposal site. Guidance for submitting an exemption request is provided in the NRC Regulatory Issue Summary 2016-11, Request to Dispose of Very Low-Level Radioactive Waste Pursuant to 10 CFR 20.2002.

PG&E can either dispose of its 10 CFR 20.2002 waste at either the WCS disposal site or at the USEI disposal site. PG&E used both sites for disposing of 10 CFR 20.2002 waste generated during the decommissioning of HBPP.

Mixed Waste

An additional consideration will be the need to dispose of mixed LLW. Mixed wastes contain both a radioactive and chemical hazard, requiring increased controls on the disposal requirements for these wastes. While mixed LLW will represent a relatively small fraction of the overall waste volume generated during DCPP decommissioning, the disposal costs per unit volume are magnitudes higher than non-hazardous LLW.

Solid Radioactive Waste Transportation

The transportation of Solid Radioactive Waste can be divided into two timeframes before all fuel is transferred to the ISFSI and after it has been transferred to the ISFSI.

During the first timeframe, all the LLRW should be generated by:

1.) The System and Area Closure Plan's removal of either contaminated systems or system components
2.) The Decontamination Plan's removal of radiologically contaminated hazardous and/or regulated materials

During this timeframe, those contaminated waste products will be packaged and prepared for transport (e.g., characterized, profiled, manifested, etc.) at or near the point of origin. High-sided intermodals will be the preferred container for packaging the waste.

Once the container is ready to ship, it will be transferred to a staging area. Once the staging area has six intermodals, which is how many can fit on a railcar, the intermodals will be moved to the Pismo Beach Railyard for transporting to the designated disposal facility.

Given this, LLRW shipments will move out of the DCPP's site on an intermittent basis as opposed to being moved off-site daily.

After the fuel off-loading campaign has been completed and all the spent fuel assemblies and special nuclear materials have been transferred to the ISFSI, the daily amount of radioactive waste required to be processed and packaged will increase significantly.

4.1.1.7.3. Liquid Radioactive Waste

Liquid Radioactive Waste and Disposal

The Liquid Radioactive Waste Plan requires the development of a system and associated procedures to process LRW to acceptable radioactivity concentration levels and ensure compliance with all other permitting requirements prior to disposal.

The Liquid Radioactive Waste Plan further requires the capability to process radiologically contaminated water to reduce the radioactive content to acceptable levels during all stages of decommissioning. Because the existing plant's LRW treatment system will be included in the decommissioning demolition process, a temporary LRW treatment system will be required to allow the demolition of the existing plant's LRW treatment system.

LRW will be generated by each reactor pressure vessel's internals and vessels segmentation activities, draining of the SFP, collection of stormwater, draining of system components, and other activities. Accordingly, the Waste Management and Disposal Plan includes the packaging and disposal of minor amounts of LRW.

The vast majority of LRW will be treated and managed through a liquid treatment and discharge program further described in the LRW Plan PMP. To meet the scheduled date for demolishing the Discharge Structure, the LRW Plan will end with the draining, processing, and discharge of the SFP LRW inventories. After the LRW Plan has been completed, if any LRW is collected during the remaining decommissioning activities, the Waste Management and Disposal Plan will assume responsibility for disposing of the LRW at an appropriate off-site disposal facility. [redacted]

Class A Spent Resin Waste Management

The LRW Plan's personnel will sluice out the spent resin into an 8-120 liner. After all the spent resin has been sluiced into the liner, the WOG will take possession of the liner and move it to another location to prepare it for shipment off-site for disposal.

The spent resin will be vacuumed out of the liner and into an IP Type 1 B-25 box that has been caulked at all corners with a silicone sealant to make certain that the B-25 box is not only "strong-tight" but also watertight.

A modified lid will then be placed on top of the B-25 box with two ports in its modified closure lid -- an extraction port and a return port. A HEPA filter will be inserted into the "drying system." The intake of the HEPA filter will be connected to the extraction port, and the exhaust of the HEPA filter will be connected to the B-25 box's return port. The drying system will be activated, and the status of the contents of the B-25 box will be checked periodically to determine when "cracking" is visible in the residual spent resin inside. At that point, any remaining sluiced resin will be added to the B-25 box after vacuuming off as much of the surface water as practicable. By then, the resin will have settled to the bottom of the liner, and the water will be on top of the resin's particulate matter. The process will be repeated until all the liners have been emptied.

This entire drying process may take over a week or so to complete. The modified lid on the B-25 box will then be replaced with a traditional gasketed bolt-down lid, with the semi-dry spent resin in the box. The resultant LRW will be characterized, profiled, manifested, and shipped off-site for disposal.

Class B Spent Resin Waste Management

The procedure for drying waste is essentially the same as that discussed above, with one notable exception: The spent resin will not be transferred from the 8-120 liner into a B-25 box after the drying process because the liner will be placed into a cask for shipment to the WCS disposal site in Andrews, Texas.

A specially fabricated lid for the 8-120 liner with extraction and return ports will replace the modified B-25 lid discussed above in the Class A drying system.

4.1.1.7.4. Hazardous and/ or Regulated Material

Hazardous and /or Regulated Waste and Disposal

This waste classification consists of all known hazardous and/or regulated material waste that is generated by the various decommissioning activities.

Note: Other plans' scope of work may generate the need to abate and remove hazardous and/or regulated materials, but those instances would be related to a previously unknown condition.

Hazardous and/or regulated material waste includes, but is not limited to, the following:

- Asbestos-containing materials
- Lead
- PCB-laden material (e.g., transformer oil)
- Universal waste:
    - ☐ Photovoltaic modules that are associated with solar panels
    - ☐ Batteries, which include most everyday type batteries, AAA, AA, C, and D; button cell batteries; 9-volt batteries; and all others (both rechargeable and single use) because batteries can contain cadmium, copper, and, in older batteries, mercury
    - ☐ Cellular telephones and pagers because they can contain antimony, arsenic, beryllium, cadmium, copper, lead, nickel, or zinc
    - ☐ Electronic waste, including printed circuit boards, and cathode ray tubes because they may contain arsenic, cadmium, lead, or PCB
    - ☐ Fluorescent lamps and light ballasts containing mercury

- ☐ Other mercury-bearing wastes such as thermometers and thermostats
- ☐ Partially full aerosol cans that contain propellants such as propane and butane

- A known TPH (total petroleum hydrocarbons)-contaminated soil area is adjacent to the Turbine Building, but it cannot be remediated until the building is demolished; it will need to be further characterized during the Site Characterization following shutdown to determine exact contamination levels and the size of the area impacted. Once the extent of this TPH-contamination is determined, any contaminated soil will need to be treated and/or removed in accordance with the relevant regulations for TPH-contaminated soil and any prior commitments.

Additional discussion on the transportation and disposal of hazardous waste can be found in Section 4.1.1.3.

4.1.1.7.5. Non-detectable Material (Clean Waste)

Non-detectable Waste and Disposal

Non-detectable materials exhibit no radiological activity exceeding background radiation levels. The NRC does not restrict the disposal of these materials.

Non-detectable materials will be dispositioned one of the following ways:

- A portion of the non-detectable concrete rubble will be crushed and screened on-site by the MMG and then be used as backfill during the final site restoration phase of the DCPP site decommissioning project in accordance with the Final Site Restoration Plan’s scope of work.
- All non-detectable concrete rubble that’s not needed for backfill will be shipped and disposed of off-site as demolition debris.
- Non-detectable metallic materials, ferrous and non-ferrous, will be recycled and repurposed via sale to a metal recycler that will ship them to an out-of-state end user.
- Non-detectable general debris that is not suitable for recycling (e.g., drywall, ceiling tile, and wood) will be shipped to an out-of-state disposal facility for disposal.
- Currently, La Paz County Landfill in La Paz, Arizona, is the most likely candidate to receive the non-detectable general debris, given its proximity to the DCPP site and ability to accept general debris via rail.

Non-Detectable Waste Transportation

Like the transportation of Solid Radioactive Waste, Non-Detectable Waste Transportation can be divided into two timeframes – before all spent fuel is transferred to the ISFSI and after it’s transferred to the ISFSI. During the first timeframe, non-detectable waste will be generated by the demolition of outlying buildings outside of the main PA.

Non-detectable materials will be processed and prepared for shipment in the waste processing area, Parking Lot 7.

The non-detectable concrete waste will be repurposed by the MMG by crushing and screening it, then stockpiling it on-site for future use as backfill.

The MMG also will downsize and prepare ferrous and non-ferrous materials for out-of-state recycling. These materials will be loaded into intermodals, then transferred to the transportation staging area in Parking Lot 8.

Once the staging area has six intermodals (the number that can fit in one railcar) loaded with ferrous and non-ferrous scrap metal, the intermodals will be moved to the Pismo Beach Railyard for transport to the designated out-of-state recycling facility.

Any remaining general demolition debris will be loaded into intermodals lined with soft-side liners, then moved to the transportation staging area in Parking Lot 8.

Once 50 intermodals loaded with general demolition debris are in Parking Lot 8, they will be moved in the evening to the Pismo Beach Railyard and will be transferred to gondola railcars the next day.

Again, as was the case with the LLRW waste shipments, the non-detectable waste shipments will leave the DCPP site on an intermittent basis as opposed to being moved off-site daily.

For the second timeframe, non-detectable materials generated by the demolition of the power block structures, including the Turbine Building and the Intake Structure, will be processed and prepared for shipment in the waste processing area, Parking Lot 7.

The non-detectable concrete waste will continue to be repurposed by the MMG by crushing and screening it. Then it will be stockpiled on-site for future use as backfill.

Once the MMG has crushed and screened a sufficient amount of non-detectable concrete rubble to satisfy the site's backfill needs, the remaining material will be disposed of out-of-state in a regulatory compliant manner.

The MMG also will continue to downsize and prepare ferrous and non-ferrous materials for out-of-state recycling. The prepared ferrous and non-ferrous materials will be loaded into intermodals. Once loaded, the intermodal will be transferred to the transportation staging area in Parking Lot 8.

Once the staging area has six intermodals (the number that can fit in one railcar) loaded with ferrous and non-ferrous scrap metal, the intermodals will be moved to the Pismo Beach Railyard for transport to the designated out-of-state recycling facility.

The general demolition debris that remains will be loaded into intermodals lined with a soft-side liner, then moved to the transportation staging area in Parking Lot 8.

Once 50 intermodals loaded with general demolition debris are in inventory in Parking Lot 8, they will be moved in the evening to the Pismo Beach Railyard and will be transferred to gondola railcars the next day.

At no time will more than 50 truckloads of waste material depart the DCPP's site on any given night.

4.1.1.8. Materials Management

4.1.1.8.1. Materials Management

The total cost of Materials Management during the license termination phase is provided in Table 4-1.

Decommissioning activities will eventually return the site to a native natural appearance, with the manmade materials demolished and many materials sent to off-site landfills. Materials management deals with the materials that have some residual post-decommissioning value and can serve a purpose rather than being disposed of in a landfill. These materials can be reused, repurposed, sold, or recycled. For example, recoverable commodities, such as copper, and components, such as pumps, motors, valves, switch gear, and transformers, could be valuable assets.

The main scope of Materials Management is to identify the assets and commodities and define how the assets will be dispositioned to minimize waste and potentially reduce the cost of decommissioning. The assets and commodities may be resold, recycled, repurposed, or reused at other PG&E facilities. Proper planning is required to efficiently and effectively identify and recover the optimal amount of assets and commodities.

When discussing Materials Management, several terms are commonly used that should be clarified to avoid confusion. The terms are:

- *Candidate Materials*: Commodities, equipment assets, and equipment components such as pumps, motors, valves, switchgear, tools, mobile equipment, furniture, and transformers that are under consideration to be repurposed, reused, resold, or recycled.
- *Ferrous Metals*: Metals that contain iron; in this setting these would include steel, steel alloys, stainless steel, and galvanized steel.
- *Non-Ferrous Metals:* Metals that do not contain iron; in this setting these would include aluminum, brass, bronze, copper, Inconel, nickel, silver, and titanium.
- *Release (verb and its various forms):* The free release of materials without restriction for repurpose, reuse, resale, or recycle into normal commerce; materials not exceeding radiological unrestricted-use threshold(s) determined in the Decontamination Plan and/or Waste Management Plan (WMP).
- *Releasable Materials:* Materials that have been determined will be released, including those that will be processed or decontaminated prior to release.

Within the overall scope of DCPP decommissioning, the following general categories of candidate materials will be generated.

- Inventoried equipment assets (in use)
- Inventoried equipment assets (spares)

- Non-inventoried assets
- Ferrous metals
- Non-ferrous metals
- Asphalt
- Concrete

The following typical proportions (on a weight basis) of candidate metals can be expected from the total quantity of metals removed from a plant of this construction and size (the reference plant is a 1,000 megawatt electrical (MWe) pressurized water reactor, comparable to the 1,190 MWe Units 1 and 2):

- Carbon Steel: 75 to 80 percent
- Stainless Steel: 15 to 20 percent
- Galvanized Steel: 3 to 4 percent
- Copper: 1 percent
- Inconel: 0.3 percent
- Lead: 0.1 percent
- Aluminum, bronze, brass, nickel, and silver: <0.1 percent each

The candidate materials will be available at different times, depending on their category. For example, spares that are no longer required for operation will be available for potential resale after both units are shut down, while much of the concrete and ferrous metal will be available only during and after demolition.

Radiologically Impacted Candidate Material

The future release of radiologically-impacted candidate materials would require prior decontamination. Studies have shown the infeasibility of decontaminating most radiologically-impacted materials generated by decommissioning to levels low enough to release at a reasonable cost.

However, in coordination with the Decontamination Plan, and based on the conclusions in those other plans and coordinated with this plan, the only radiologically-impacted candidate materials in the project that can realistically be considered for transfer to the MMG are limited to the following:

- Radiologically-impacted assets that could potentially be resold and transferred without decontamination or release. This would require shipping in radiologically-rated shipping containers and would be limited to buyers who could use such impacted equipment within the framework of existing regulations (e.g., another nuclear power plant).
- Limited ferrous and non-ferrous metals with low-level surficial contamination. These materials would require decontamination.

Inventoried Equipment

Current radiologically-impacted equipment and large components in use could be considered for repurpose or sale, but historically there has not been domestic market interest in California or elsewhere in purchasing or repossessing radiologically-impacted equipment and components from decommissioned nuclear plants, including assets from Zion Nuclear Power Station in Illinois, HBPP in California, and SONGS in California.

Efforts to decontaminate radiologically-impacted equipment are shown to not be cost-effective. Low-level-contaminated equipment could potentially be repurposed on a rare case-by-case basis if a buyer is identified that will not require the equipment/components to be decontaminated.

In general, the cost-effectiveness of repurposing any radiologically-impacted equipment will be decided by the following:

- Identifying a buyer for equipment in a radiologically-impacted condition
- The salable value of the asset minus the cost to transport it compared to the cost to transport and dispose of the item

Potential buyers could include the decommissioning contractors, if they could use such equipment. Interested contractor(s) would then conduct their own cost-benefit analysis to evaluate whether to take possession of the equipment and dispose of it at the end of the project or decontaminate the equipment before removing it from the site. For resale or repurpose to be cost-effective, the cost to ship the equipment minus the value derived from the asset transfer must be less than the transport and disposal cost. As stated above, the evaluation is predicated on having buyer/market interest in such equipment.

Ferrous and Non-Ferrous Metals

Radiologically-impacted ferrous metals are present in the Containment Buildings, Building 403 (OSGSF), the Auxiliary Building, and in the RCA. The ferrous metals are comprised of structural members, equipment, various tanks, piping, and reinforcing steel within the concrete structures. Radiologically-impacted ferrous metals are not marketable as scrap – the metals must be decontaminated before they are shipped off-site as scrap.

These metals will be separated as a result of the demolition activities, rather than as an intended activity to salvage the metals. Previous evaluations have shown that it is technically impractical and cost prohibitive, even when separated, to attempt to decontaminate most impacted ferrous metals for release. Only metals with smoother exposed surfaces (e.g., plate steel) could potentially be considered for decontamination. Thus, decommissioning will only attempt to decontaminate and release ferrous metals if it is cost-effective to do so at that time. This approach is consistent with industry practice on other recent nuclear plant decommissioning projects.

A comparability/order-of-magnitude cost comparison demonstrates that it is not cost-effective to decontaminate impacted candidate materials based on current pricing. The comparison is based in part on expected decontamination costs, which can range between $1,000 to $3,000 per ton. This cost estimate does not account for the decontamination of any impacted ferrous metals in the project.

Any future consideration to decontaminate and release materials would be made on a case-by-case basis during field implementation considering levels of contamination, the complexity of the materials (e.g., plate steel compared to piping), and any changed economics of doing so (such as metal having a much higher scrap value than its current scrap value).

The presence, handling, and decision-making process regarding decontamination and recycling of radiologically-impacted non-ferrous metals is identical to the description for ferrous metals, except that the non-ferrous metals will have a higher scrap value. The scrap value will vary considerably based on the type of metal (copper, aluminum, stainless steel, etc.); a cost breakdown demonstrates that non-ferrous materials likely cannot be cost-effectively decontaminated using current pricing.

Any future consideration to decontaminate and release non-ferrous materials would be made on a case-by-case basis during field implementation, considering levels of contamination, the complexity of the materials (e.g., plate steel compared to piping), and any changed economics of doing so (such as metal having a much higher scrap value than its current scrap value).

Non-Radiologically-Impacted Candidate Materials

This section describes the candidate materials expected to be generated in the project in a form that is not radiologically impacted — that is, decontamination would not be required prior to release.

Inventoried Equipment Assets and Large Components

PG&E maintains a substantial inventory of equipment assets, large equipment, spare parts, and tools. Part of that inventory is in use. A large portion of this inventory is expected to have resale value, which will decrease quickly after shutdown.

It is typical in the demolition industry to resell this equipment and assets to the extent practical and to scrap the equipment that is impractical to handle or resell intact, as described further in a later section. It is consistent with industry practice and other nuclear plant decommissioning projects not to dispose of these materials as waste in a land disposal facility if it can be avoided.

During the planning phase of the project, efforts will be made to sell in lots as many of the assets as possible and to sell directly to other buyers when possible (rather than going through an auction), targeting specific out-of-state end users. If equipment were sold to another nuclear facility, it would require that all equipment-related documents have been kept through the life of the equipment and are traceable via Certified Material Test Reports, Purchase Orders, certifications, and similar documents for each item of equipment or material.

Assets that cannot be sold may be donated. Assets that cannot be donated will be scrapped if comprised of recyclable material (steel, aluminum, etc.). Assets that cannot be scrapped will be disposed of as waste.

Ferrous and Non-Ferrous Metals

Clean ferrous metals include large quantities of structural elements and components, concrete reinforcing, piping, large and small equipment, site fencing and guardrails, transmission towers, and trailers and containers. These metals can be intentionally separated and processed during demolition activities for release. Structural rebar will be segregated from any concrete that is to be crushed for reuse. It is typical in the demolition industry to separate these metals for scrap to the extent practical, as described further in a later section. It is consistent with industry practice in general, and at other nuclear plant decommissioning projects not to dispose of these materials as waste in a land disposal facility.

Clean non-ferrous metals are present throughout the site buildings in the form of equipment, piping, cables, electrical equipment and switchgear, and specialty equipment. These metals can be intentionally separated and processed during demolition activities for release. It is typical in the demolition industry to separate these metals for scrap to the extent practical, as described further in a later section. It is also consistent with industry practice in general, and at other nuclear plant decommissioning projects, not to dispose of these economically separable materials as waste in a land disposal facility.

Within California, there is virtually no end processing (e.g., smelting) of scrap metal. The local and regional recycling companies function as brokers and process and/or size the material before moving the scrap to larger companies, which in turn move the scrap typically to international locations through the port of Long Beach in California.

Every company or broker involved in the metal scrap chain between the site and the recycling endpoint further depletes the scrap value because of compounded costs for their handling, transport further down the line, and profit. As an example, steel sold to a local buyer that ends up in Asia would have appreciable hidden cost buried in the gross steel value offered by the local scrap (i.e., brokering) dealer.

The cost-effective and realistic options for scrap metal are as follows:

- Ship the scrap to Asia, through the Port of Long Beach in California
- Ship the scrap metal to Salt Lake City, Utah

Scrap could be sold to closer buyers in Nevada, for example, but Utah is the closest out-of-state major scrap marketplace and the likely end destination for any scrap sold in Nevada or Oregon. So, the scrap sold in Nevada would incur the additional handling fees and profit costs described above, and it is more cost-effective for the project to ship the scrap directly to the end destination(s) in Salt Lake City, Utah.

While shipment of scrap to Asia currently appears to be the most cost-effective option for ferrous scrap, it is not more cost-effective for non-ferrous scrap. Selection of domestic or international buyer(s) at the time of scrap sales/shipments would be based on the ever-fluctuating commodity market prices at the time that the scrap is actually sold. For planning purposes, the cost estimate for materials management assumes that all scrap metal would be shipped to Salt Lake City, Utah, rather than to Asia.

Concrete

Clean concrete demolished on the project will be suitable material for release. Given the weight and quantity of concrete on the project, it is preferable to reuse as much concrete onsite as possible. Clean concrete includes the concrete tri-bars that have not been in service on the breakwaters. The tri-bars that have been in service are expected to be contaminated by the saline marine environment, rendering them unsuitable for use on a clean-engineered fill and requiring off-site disposal.

Concrete can be reused on-site because the Final Site Restoration activities can accept concrete for reuse as part of an engineered fill. Approximately 10 percent of the clean concrete generated during decommissioning will be releasable but will be surplus quantity that cannot be incorporated into the engineered fill and instead will be recycled off-site.

A waste processing area located on-site will have concrete crushing and screening equipment. Non-detectable concrete rubble will be repurposed via crushing and screening in order to manufacture concrete aggregate that will be used as backfill during the final site restoration phase of DCPP decommissioning. The reuse of concrete on-site maximizes potential cost avoidances and represents the lowest project cost for disposition of concrete. Reuse of concrete on-site saves the cost of backfill soil, plus the cost of transporting and disposing of the concrete off-site.

Although shipping concrete out-of-state for recycling would be unusual, in the context of this project it may be possible if more cost-effective than disposal. The cost scenario for this option assumes that the concrete is recycled in Las Vegas, Nevada, because that is the closest out-of-state major recycling market, and it would reduce the transportation cost compared to transport to Salt Lake City, Utah, which makes recycling even more attractive compared to disposal.

The out-of-state recycled concrete would be shipped by truck. The concrete recycling facility would need to be able to accept about 35 intermodal containers per month during demolition activities, given the following:

- An anticipated estimate of 31,000 tons of concrete to be recycled by the end of the Final Site Restoration; 319,540 tons of concrete is expected to be released from Building Demolition and FSR, minus an anticipated 288,810 tons of released concrete that can be incorporated into on-site restoration activities in the FSR.
- The anticipated schedule that will generate releasable concrete during demolition activities over at least 45-months
- Truck capacity of 20 tons
- All concrete generated in the ISFSI site restoration is expected to be reused on-site

Asphalt

Most asphalt present on paved roads and parking areas outside the RCA is expected to be releasable from site. Released asphalt may be reused on-site temporarily if required by the Site Infrastructure Plan (SIP), but even reused asphalt will eventually require export from the site as determined by the ISFSI site restoration. Ideally, released asphalt would be recycled.

All aspects of the asphalt recycling market are virtually identical to concrete, except that asphalt will not be permanently reused on-site. Thus, all asphalt removed during decommissioning will need to be shipped off-site.

Releasable asphalt can be shipped to recycling companies. Almost all the releasable asphalt would be generated in the FSR activities. The recycling company(ies) would collectively need to be able to accept about 242 truck shipments per month during demolition activities, given the following:

- An anticipated 48,230 tons of asphalt to be removed in the FSR activities
- The anticipated schedule that will generate releasable concrete during 10 months in the FSR
- Truck capacity of 20 tons

Disposition for Candidate Material

This section discusses the various options for disposing of released material.

Asset Sales

Asset sales are a potential way to recover residual market value in new and used equipment and materials, including asset inventories, especially if the items have significant individual value. Asset sales are often managed through auctions, though items of value can be sold or transferred by the owner directly to another party without going through an auction.

Auctions can be managed by specialty auction firms that receive a portion of the sale proceeds (typically 5 percent) in return for their service to run the auction and manage the purchase, payment, and distribution of the sold merchandise. Alternatively, an auction can be managed by the project owner — saving the auction commission but requiring multiple staff throughout the auction and distribution periods.

Asset sales must be managed carefully to avoid potential negative occurrences, including the following:

- Often, assets cannot be sold directly from their current location and must be removed, transferred to other location(s), protected, and loaded before the buyer takes legal responsibility for the item. The cost for the owner to remove, protect, and load many of the items can exceed the asset sale value or even the disposal cost if the item were to be disposed of rather than sold. These evaluations for most of the smaller items are impossible at an item-by-item level and must be evaluated at a program level.

- Typically, about 80 percent of the program asset value would be derived from about 20 percent of the DCPP equipment. The specific percentages are not critical in this evaluation, but rather the concept that a small proportion of assets will generate a large proportion of the asset value of a sales program. It is only this small percentage of equipment that would be recommended for further consideration to be included in an auction. The remaining assets would have little net value when factoring in the cost of running the auction program(s) and should be scrapped or disposed of without being offered for sale.
- DCPP is remote and will have security restrictions when asset sales are most likely. This would complicate the logistics and staffing efforts for transferring sold items to buyers for pickup or delivery. An alternative is to move the assets out of the restricted area or off-site at considerable additional cost.
- In recent nuclear plant decommissioning projects, including the SONGS decommissioning, equipment with perceived residual resale value was offered for sale, and these items garnered little or no interest in the market. One factor is the reluctance of secondary buyers to purchase and own items from a nuclear plant. Another factor for large items like the turbines is the limited number of prospective buyers that can use the exact size and setup of the specialty equipment, coupled with the significant cost and effort to transfer the equipment.
- Equipment that may have resale value may still be needed or of use during the early phases of decommissioning. For example, SONGS sold the trolley cranes from the cold machine shop during an initial asset sale, and these were no longer available for maintenance of plant equipment or vehicles.
- PG&E may have to ensure that the sold component can perform its intended function, requiring maintenance, testing, and other services before the sold item can be transferred to the buyer.

In summary, the sale of assets needs to be considered carefully before embarking on an asset sale campaign. Some assets removed from the plant have substantial potential value that can only be realized if a buyer can be found and if the buyer’s timing is optimal. Other assets will not create enough market interest to drive a worthwhile asset sale. Carefully selecting the inventory for the potential asset sale is important to maximize the resale value and to minimize PG&E’s cost to execute the sale.

Repurpose Material for Use On-site

An overall goal of DCPP decommissioning is to reduce the amount of material that is disposed of in a landfill/burial facility. Through waste minimization efforts, PG&E can realize sustainability achievements that will benefit the community and the surrounding environment. Maximizing the amount of materials reused on-site will help mitigate project costs by minimizing waste disposal and transportation costs.

Repurposing simply involves taking a material and reusing it for another purpose on the site. Because the site is planned to be returned to a native condition, repurposing potential in the project is limited to the following:

- Incorporate released materials into site infrastructure improvements that are necessary to support the long-term operation of the ISFSI or the 500-kV switchyard
- Incorporate material into the restored site and/or native landscape for Final Site Restoration

The early timing of the infrastructure improvements will not align with the later generation of releasable asphalt and concrete materials.

Released concrete can be crushed and incorporated into the site restoration grading by blending it with fill material to create an engineered fill. Final Site Restoration envisions blending crushed concrete into soil at a ratio of one part concrete to 5 parts soil.

Recycling

On typical demolition projects, materials consisting of large equipment, tools, ferrous metals, non-ferrous metals, concrete, and asphalt are recycled in the local and regional market near the site. The current conditions of applicable markets to accept such materials and the effect of California Executive Order D-62-02 that potentially restricts the in-state recycling market force such scrap to go out-of-state.

Recycle/Scrap

Materials consisting of large equipment, tools, ferrous metals, non-ferrous metals, concrete, and asphalt are expected to have typical recycle/scrap value outside California, although the transportation costs will be higher.

Recycle/Scrap Internationally

Materials consisting of large equipment, tools, ferrous metals, and non-ferrous metals have the potential to be scrapped outside the United States, primarily in Asia. This has become a common way to move recyclable and scrap materials from California and is a feasible option for this project given the direct access and proximity to ports that primarily serve the Asian markets.

Options Used for Cost Estimating

Based on the information presented thus far, releasable materials will be dispositioned as follows:

- Inventoried Assets: Will be repurposed to PG&E facilities, sold to out-of-state buyers, or donated. Assets that cannot be moved in this manner will be scrapped.
- Non-Inventoried Assets: Will be repurposed to PG&E facilities or donated. Limited items may be included in asset sales. Metal assets (such as shelving units) that cannot be repurposed, sold, or donated will be scrapped. All other assets will be disposed of, including potential e-waste and universal waste.
- Ferrous Metals: Separable releasable ferrous metals will be scrapped directly to Salt Lake City, Utah.

- Non-Ferrous Metals: Separable releasable non-ferrous metals will be scrapped directly to Salt Lake City, Utah.
- Concrete: Most releasable concrete will be reused on-site as part of engineered fill for restoration in the FSR activities and ISFSI site restoration activities. Surplus or "off-spec" quantities can be recycled in Las Vegas, Nevada, because this option is more cost-effective than disposal.
- Asphalt: Releasable asphalt can be recycled in Las Vegas, Nevada, because this option is more cost-effective than disposal.

4.1.1.9. Support Services

This section encompasses costs that support overall decommissioning efforts, not attributable specific project scopes of work. These are staffing related costs and specialty contracts of project oversight, management, and support. The labor costs for discrete projects such as RPV segmentation are captured in their own PMP and cost estimate. Oversight and support staffing costs are captured in the following categories of activities:

- Project Management
- Project Controls
- Decommissioning Plant Operations
- Maintenance
- Radiation Protection
- Final Status Survey
- Security
- Safety
- Regulatory Management

The DCPP decommissioning management staff is responsible for ensuring development and implementation of budgets, plans, and schedules that result in the safe and cost-effective decommissioning and restoration of the DCPP site. The management team has responsibilities in all three phases of decommissioning -- license termination, site restoration, and spent fuel management (SFM). The activities and costs captured in this subsection pertain to license termination activities beginning after Unit 1 final shutdown through license termination. In some cases, positions may be working on a combination of license termination, site restoration, and SFM activities simultaneously. In those cases, the costs are broken out by phase: License termination staffing cost is discussed in this section; SFM staffing cost is discussed in Section 4.1.2.6; and site restoration staffing cost is discussed in Section 4.1.3.5.

An ancillary function of Support Services is to provide staffing for the Emergency Response Organization (ERO). A study was performed to ensure that DCPP has enough on shift staffing and ERO members to respond to postulated events for a decommissioned plant. The study identified the critical positions and the number of personnel needed to adequately staff those positions. The positions needed were compared to the staffing plan, and the plan was found to contain adequate staffing to provide for the ERO.

4.1.1.9.1. Project Management

A small team of PG&E management personnel and specialty contractors was assembled in mid-2016 to develop a decommissioning strategy. After the decommissioning strategy was approved by PG&E management, early planning was initiated.

The early planning started with staffing the decommissioning organization with the individuals who were skilled and experienced in developing the needed deliverables. These included the PMPs, cost studies, schedules, and site-specific DCE that would drive the decommissioning from final unit shutdown to completion of license termination and site restoration. The early planning phase started in early 2017 and will be completed in early 2019. Once the early planning phase is completed, the decommissioning organization will shrink to a staffing level needed to support the development of more detailed plans and schedules. The management team will undergo a slow ramp-up between 2019 and the final shutdown of Unit 1. The ramp-up will be based on the increased workload as the shutdown approaches.

Immediately prior to Unit 1 final shutdown, the Project Management team will verify that the plans, permits, license changes, regulatory notifications, regulatory approvals, and staffing are in place to transition directly from the operating condition to decommissioning. The Project Management team that will pursue license termination will consist of the managers and directors who will be responsible for the organizations listed in Table 4-19 within the decommissioning organization.

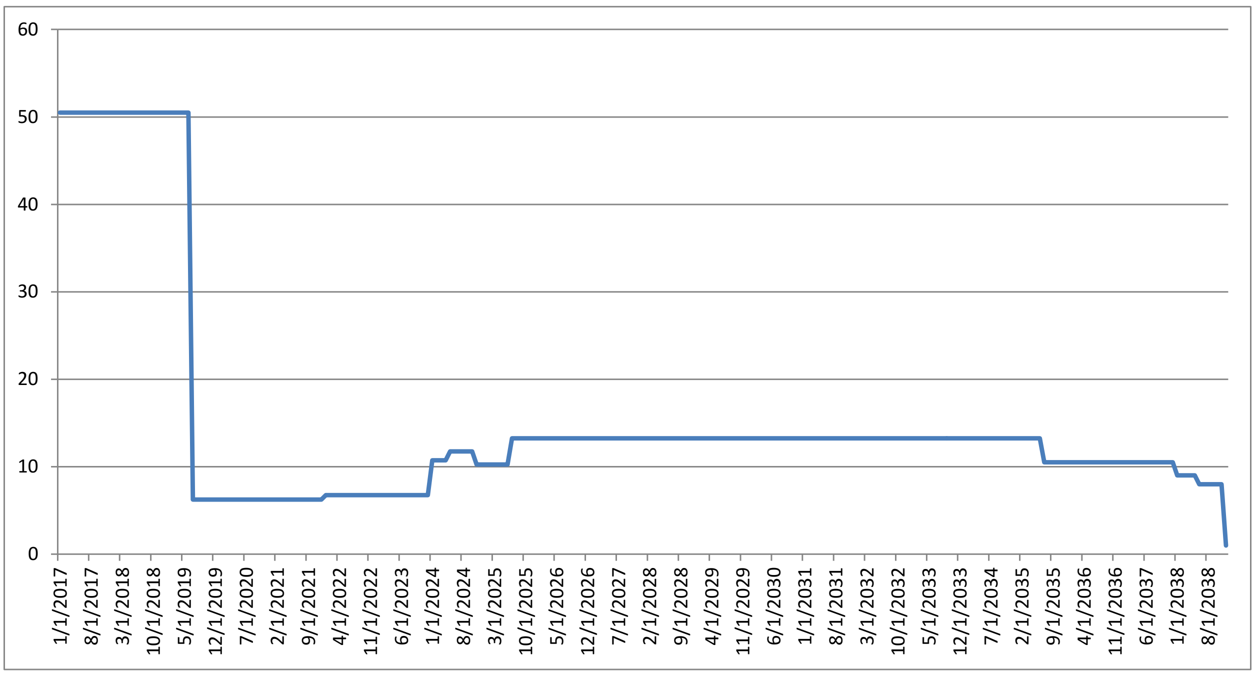
Table 4-19: Decommissioning Organization

Organization	Role
Projects	Oversight of the discrete scopes of work
Engineering	Oversight and support of work planning efforts, PMP development, design change reviews, transition planning, ISFSI and security upgrades, and site restoration planning. The engineering group is embedded in the Decommissioning Projects organization.
Operations	Monitoring and movements of SNF in the SFP and the monitoring and manipulating of the mechanical and electrical systems at the plant. The Operations group is embedded in the Support organization.
Maintenance	Maintenance of critical components needed for the safe storage of SNF in the SFP and to respond to repair requests and keep the site in good working condition and maintained to a safe level. The Maintenance group is embedded in the support organization.
Radiation Protection	Oversight of the radiological protection for the public, environment, and personnel on-site

Organization	Role
Security and Emergency Services	Protection of SNF, GTCC, and regulated quantities of radioactive material; and control of personnel access to the site and planning for and responding to emergencies at the site
Project Controls	Development and maintenance of accounting, cost control, and scheduling activities

The Project Management team will remain in place until the discrete scopes of work are complete. Several organizations will be combined and staffing reduced after building demolition is complete; staffing ramp-down will continue until the FSR is complete. After FSR is complete, the Project Management team will be combined under the authority of the Director of Security and Emergency Services. Figure 4-28 shows the general staffing levels with ramp-up and ramp-down periods.

Figure 4-28: Project Management Staffing



The cost of Project Management Staffing to support license termination is included in Support Services in Table 4-1.

4.1.1.9.2. Project Controls

Project Controls includes a wide array of accounting, cost control, and scheduling activities needed to plan and execute a large project such as DCPP decommissioning. Decommissioning Support provides the expertise for Document Control and Records Management System (DC/RMS), while the mission of the Project Controls organization is to provide financial oversight of the decommissioning project, including tracking conformance with established budgets and schedules, maintaining financial records, preparing communications pertaining to the financial status of the decommissioning for state and federal regulators, and preparing and submitting required reports to regulatory agencies such as the NRC, CPUC, and DOE.

For ease of reporting and estimating, the DC/RMS functions are noted in this section. The DC/RMS specialists process, distribute, and store procedures that have been created, revised, or retired; maintain project records; coordinate retention of digital, paper, and archival records; and send, track, and receive submittals, contractual responses, correspondences, and requests for additional information (RAIs) for decommissioning management. It is important to note that closure of the following activities and the retention of those records will each have to adhere to their own unique and separate standards set forth by federal regulations, California regulations, local regulations, the nuclear industry standards, PG&E's nuclear insurer, PG&E standards, PG&E's commitments to the community, and the community's expectations. The following are some of the DC/RMS activities that PG&E will be expected to perform:

Records Retention: PG&E will have to sort and archive all final records from the decommissioning project. The required retention periods and retrievability requirements will need to be determined for each record and the record processed accordingly. Most records will be disposed of within three years. However, many records, such as the radiological records, must be retained for at least 10 years after license termination and records associated with SNF must be retained until well after the fuel is transferred to the DOE.

Work Package Closeout: Work packages are a compilation of instructions to workers, drawings, references, and completion records or documents that define what is to be done, how it is to be done, and how completion is to be documented. While work package execution and closure is a continuous aspect of any large project, some of the final work packages and standing work orders are expected to remain open until the physical work is completed. All work packages will be processed for final acceptance and verification to ensure that the work was documented adequately. The records will then be entered into the Records Management System (RMS) for retention and archiving in accordance with applicable regulations and requirements.

Procedures: The DC/RMS Specialist will be tasked with maintaining control of draft procedures to prevent inadvertent use of an unapproved procedure in the field, to distribute approved new and revised procedures, and to archive retired and replaced procedures.

Radiological Records: All radiological and FSS and clearances must be brought to a closure. This will include routine radiological surveys, dosimetry records, and any of the final surveys and clearances performed early in decommissioning, as well as those to close out the project. The records must be reviewed by management, approved, and entered into the RMS.

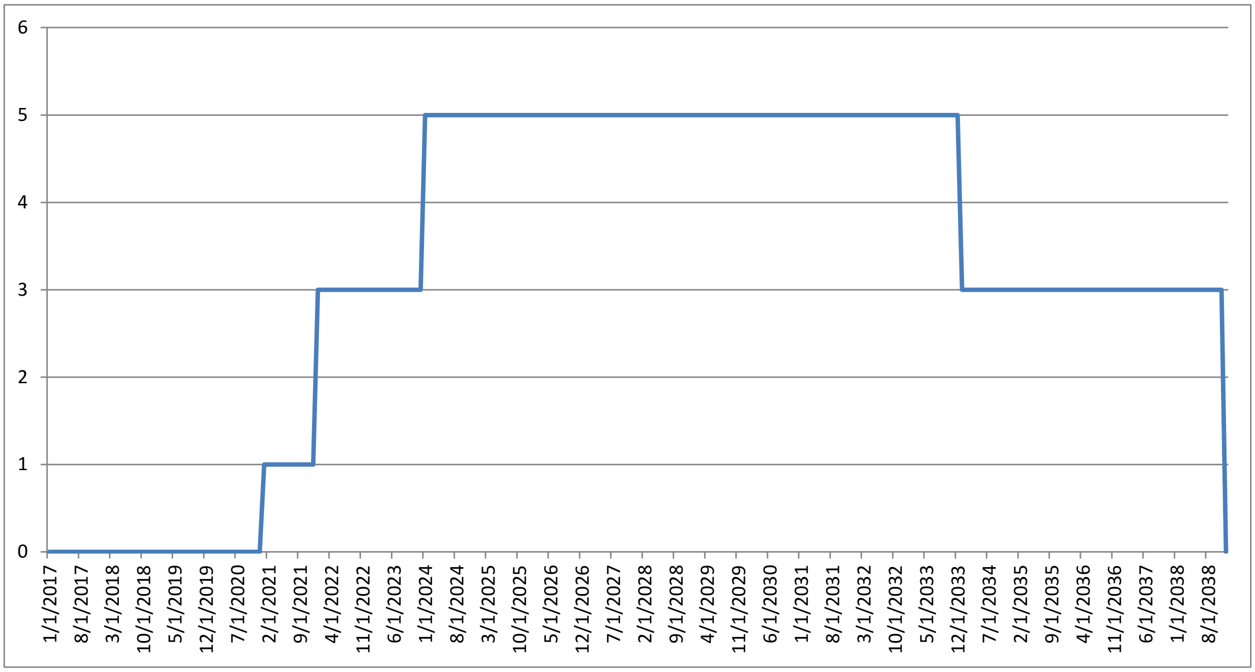
Industrial Hygiene (IH) and Environmental Sampling Records: All IH and Environmental sampling and analytical report records must be brought to closure per applicable regulations. By project closure, DCPP will have retained numerous such records related to asbestos, lead, PCBs, effluent, air and water monitoring, and treated water discharges. The records must be reviewed by management, approved, and entered into the RMS to meet records retention requirements.

SNF and GTCC records: PG&E will have to verify that all the records for SNF, GTCC, and associated packaging are complete, accurate, and retrievable. This is a long-term preparation for PG&E, since the DOE standards require adequate records and documentation prior to acceptance of any SNF or GTCC. PG&E will have to bring all packaging, fabricating, and construction records for disposition and prepare to transfer them to the ISFSI.

License modifications documentation retention: There are several license and license basis documents that will be required to be modified for final cessation of power operations and at the end of site restoration. (e.g., changes to the Site Emergency Plan). From previous experience with the NRC review and approval process, PG&E has learned that the NRC review process requires long lead times, frequent exchanges to answer RAIs, and frequent revisions to account for regulatory creep. Regulatory creep is small and iterative changes to requirements that occur during a review process. These changes are unknown at the beginning of a request for NRC approval of a particular document. Further, PG&E has learned that the NRC reviews are typically less than timely. For example, the last revision of the Site Emergency Plan at HBPP took nearly two years to gain NRC approval. The DC/RMS Specialist will be tasked with tracking and storing all license modifications as well as the communication pertaining to those modifications.

The planning phase that starts in 2019 will begin to generate documentation and records. The DC/RMS staff will begin a ramp-up in 2021 to support the increasing number of documents, records, procedure changes, and communications that are required to be maintained. The full complement of DC/RMS personnel will be in place when Unit 1 permanently shuts down and will continue until the work packages for most of the major projects have been closed. The ramp-down will occur in two steps. The first positions will be released after system removal is complete. The last positions will be released after site restoration. After site restoration, any residual DC/RMS activities will be transferred to the Security and Emergency Services organization at the ISFSI. The ramp-down for DC/RMS is shown in Figure 4-29. The staffing costs to support the DC/RMS function are included in Support Services in Table 4-1.

Figure 4-29: DC/RMS Staffing



The Project Controls group will track decommissioning costs, track the effectiveness and efficiency of project implementation, and provide assessments of deviations of expected cost versus actual costs.

In addition to maintaining ongoing periodic performance reports, the Project Controls group will be responsible for supporting government and NDT-related filings, including annual advice letters to the CPUC, NDCTP filings, and NRC assurance of funding reports. The group will be involved in supporting all cost and schedule aspects of project management, such as purchase requisitions, vendor invoice review, contract performance tracking, risk and opportunity analysis, schedule maintenance, and contract closure.

Monthly financial reporting will be prepared and analyzed at both the overall project and individual department levels. In crafting these reports and analyzing them with the appropriate project oversight, the Project Controls group will perform robust cost evaluations to maintain project goals and finances. In reviewing and tracking various vendor invoices, it is imperative to maintain consistent accounting of the charges as they relate to the approved cost estimate. The decommissioning management team will regularly provide updates to the Project Controls group to ensure that accurate information is available on the project specifics in support of trust disbursement advice letters, NDTCP, and various other CPUC-related requirements.

Financial reporting will be provided to the entire management team each month for review and evaluation of the overall project finances. This reporting also will be used for department-level evaluation and review with each manager. The costs will be compared to the budgets by both month and year, providing trends that can be analyzed to forecast how future costs will affect the project. These forecasts will be regularly assessed and, where appropriate, adjustments may be implemented to comply with the original plan or to provide justification to support current and future plans.

Vendor invoices will be received, reviewed for appropriateness of charge, and assigned relevant accounting allocation. Accounting allocation will be assigned to each invoice based on how the charges pertain to the planned costs. Invoices pertaining to large contracts will be tracked in separate database structures to permit quick spending trends, contract and performance comparisons, and other beneficial valuations.

The Invoice Coordinators will keep invoices moving through the process so that validated invoices are paid in accordance with contract terms. The Invoice Coordinators will confirm that invoices and associated documents have been filed appropriately and will be responsible for assigning appropriate reviewers and approvers. In addition, the Invoice Coordinators will be responsible for ensuring that invoicing issues are resolved and documenting resolution of those issues. The Invoice Coordinators will review identified issues and action items as they are raised, to ensure the issue or item has not been previously identified and resolved; to determine if the issue or item requires formal resolution; and to ensure that the desired resolution or concern is clearly worded.

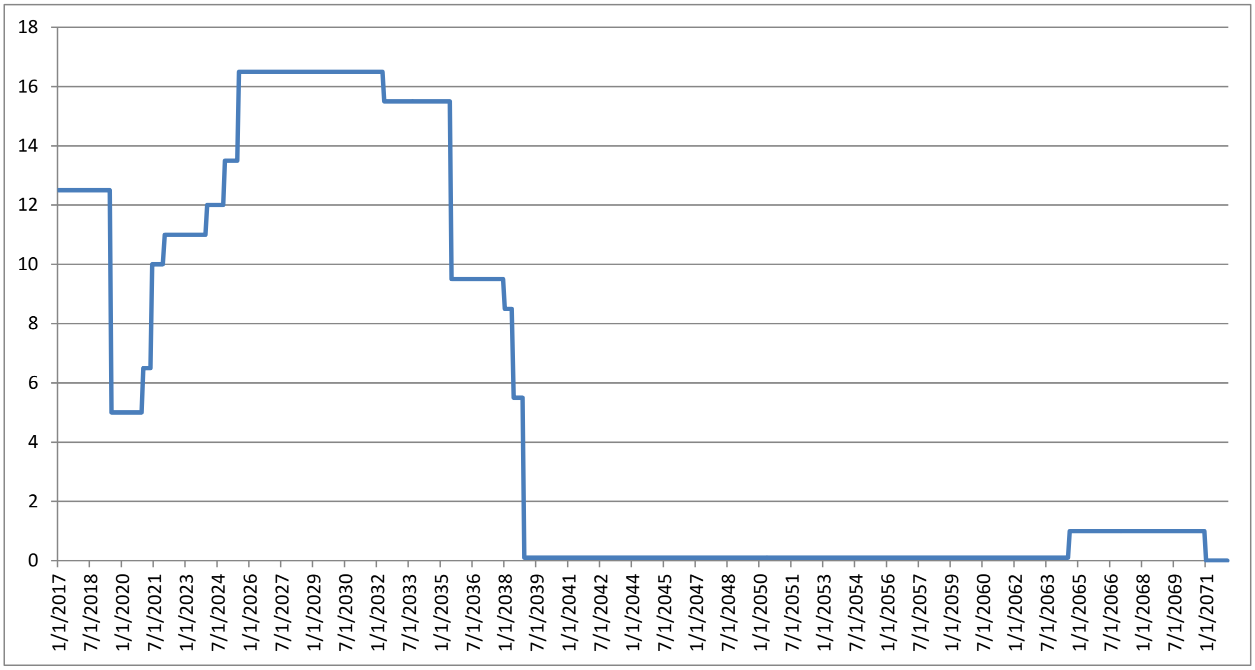
The Project Controls Schedulers will maintain the decommissioning schedule, including all activities and the critical path. The schedulers receive input from the contractors responsible for discrete scopes of work and from the PG&E staff responsible for non-discrete scopes and activities. The schedule will be updated weekly and reviewed daily with those groups that are working the activities in that timeframe.

The Project Controls group will support the early planning effort and then undergo a partial ramp-down after the contracts to support the effort are completed and the DCE is filed. As the planning process workload increases, the group will begin to ramp back up starting in about 2021 and reach full strength just prior to Unit 1 final shutdown. The Project Controls group will remain at a full complement until the 10 CFR 50 licenses are terminated by the NRC. Once the 10 CFR 50 licenses are terminated, the group will gradually ramp down to about 30 percent until site restoration is completed. After that occurs, any residual duties will be transferred to the Security and Emergency Services organization, and the Project Controls group will be disbanded.

In about January 2065, one position (a Contracts Manager) will be re-mobilized about half-time to help plan and execute fuel and GTCC transfer to the DOE; demolition and FSS of the ISFSI; termination of the 10 CFR 72 ISFSI site-specific license; and final ISFSI site restoration. The position will report to an alternate manager, likely the Security and Emergency Services Director because the Project Controls group will not be reformed in 2065. The duration is tentatively scheduled to take 6 years; the position will be released when the work is complete.

The cost of staffing for Project Controls is included in Support Services in Table 4-1. The Project Controls staffing changes are captured in Figure 4-30 below.

Figure 4-30: Project Controls Staffing



4.1.1.9.3. Engineering

Engineering staff will support a wide range of activities including the work planning efforts, PMP development, design change reviews, transition planning, ISFSI and security upgrades, and site restoration planning. The engineering group will begin a ramp-up in 2019 to support the planning effort and will consist of a manager and at least one engineer for each discipline such as civil, electrical, fire protection, nuclear, security, and mechanical. Engineering is responsible for reviewing designs and design change packages, verifying calculations, validating project management plans, reviewing work packages, updating drawings, and processing any engineering changes to the design basis or license basis of the remaining plant; and verifying that documentation of completed work is completed and submitted to records management in a timely manner. Engineering will remain engaged until their specific project assignments are completed. The engineering group will begin a gradual ramp-down after transfer of SNF and GTCC wastes to the ISFSI are completed, except for one engineering staff assigned to ISFSI for required reports. The final ramp-down will occur after site restoration is completed and 10 CFR 50 licenses for both units have been terminated.

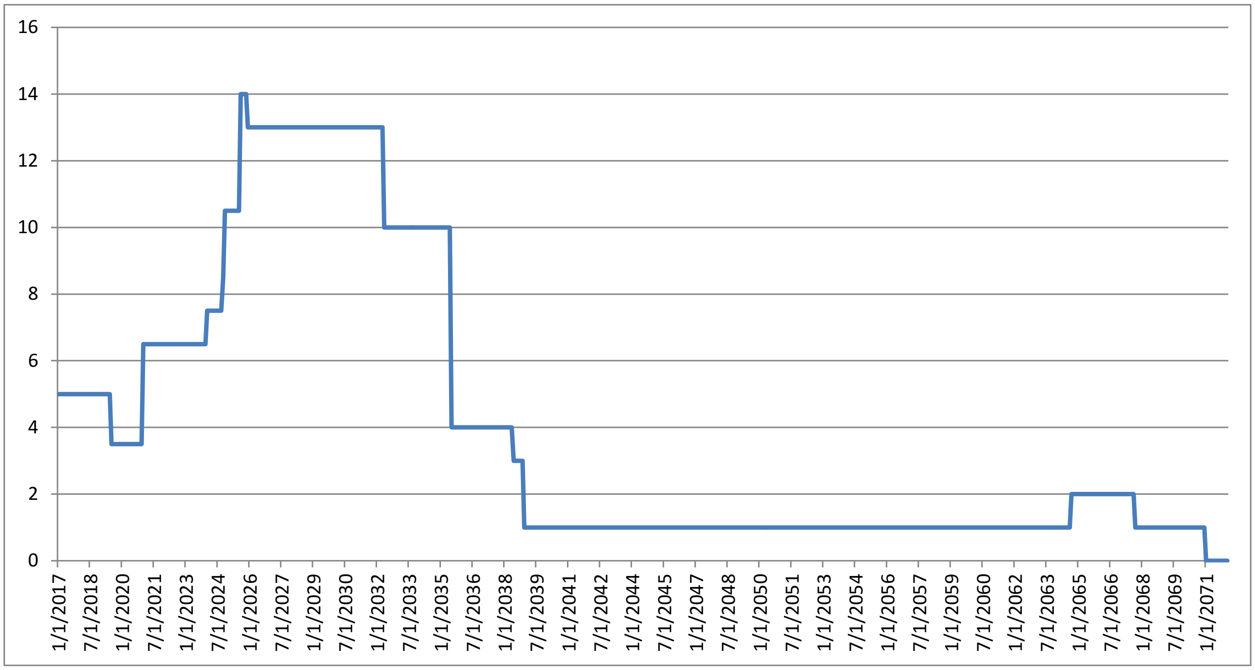
Several positions are a part of the Projects organization and are accounted for in this section for convenience of calculation. They include the:

- Oversight positions responsible for monitoring and tracking discrete work, such as plant systems removal and RPV segmentation
- Waste specialist who will oversee the packaging, handling, classification, and shipment of various types of waste

- Work control specialists who develop, review, and approve work packages

The cost of staffing for this group for license termination activities beginning after Unit 1 final shutdown is included in Support Services in Table 4-1. The group staffing changes are captured in Figure 4-31 below.

Figure 4-31: Engineering Staffing



4.1.1.9.4. Operations

Operations personnel are responsible for monitoring and manipulating the mechanical and electrical systems at the plant. Prior to Unit 1 shutdown, a small group of operations personnel will be ramped up to verify that the processes, Technical Specifications (TS), and procedures for manipulating plant systems and supporting the SNF in the SFP are ready for the transition from an operating condition to a decommissioning condition. The preparations include:

- Qualifying supervisory personnel and the Operations Manager as Certified Fuel Handlers (CFH)
- Verifying that License Basis Documents, the unit licenses, and TS are ready, approved, and available for implementation upon final shutdown of the units
- Reviewing and verifying that the procedures needed to safely maintain and operate the systems in a shutdown configuration are ready and approved
- Reviewing and verifying that the programs and processes needed to safely monitor the unit in a shutdown configuration are ready and approved
- Preparing or reviewing work packages and clearance orders for the transition work to be performed

The minimum staffing levels for operators is prescribed in the TS that are attached to the operating licenses for the nuclear plant. The proposed changes to TS reduce the minimum required to a level commensurate with the nuclear safety risk posed by permanently defueled units and must be approved by the NRC before implementation.

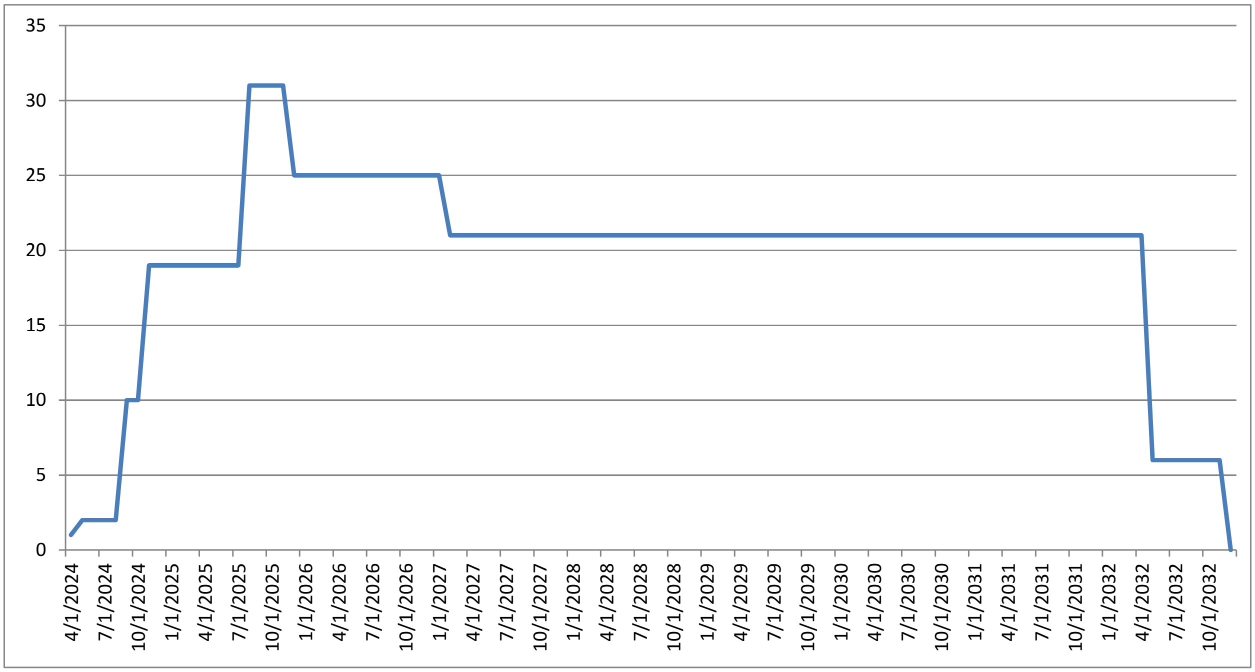
The initial assignment of individuals will begin before Unit 1 permanent shutdown and will be augmented by additional Non-Certified Operators (NCOs) at Unit 1 permanent shutdown. The NCOs will not require qualification as CFHs. The operators will provide the systems operations needed to defuel the unit, hang and verify clearance orders, drain and de-energize unneeded systems, and monitor shutdown condition parameters. They also will begin the same preparations for Unit 2 shutdown that were taken to prepare for Unit 1 shutdown.

The decommissioning operations staffing levels will remain stable until about one month before Unit 2 shutdown when the staffing levels will ramp up to provide five crews. Upon Unit 2 shutdown, the crews will provide the systems operations needed to defuel the unit, hang and verify clearance orders, drain and de-energize unneeded systems, and monitor shutdown condition parameters. The work will include system manipulation for those systems that are common between Units 1 and 2 that could not be completed after Unit 1 shutdown while Unit 2 was still operating. PG&E will implement the revised TS after submitting a certification to the NRC that the units are permanently shutdown and defueled. The certification and the implementation of the revised TS will eliminate the requirement for licensed and senior licensed operators in the control room. The open decommissioning operations positions will be filled with qualified operating staff. PG&E anticipates that the revised TS will be implemented at shut-down of the respective unit, and personnel will be shifted, at about 60 days after final shutdown.

As defined in Section 4.1.1.1.2, the decommissioning transition will start with the final shutdown of Unit 1 and will continue until the work is completed after Unit 2 shutdown. The work should continue for about one year after Unit 1 final shutdown. About 60 days after Unit 2 shutdown, the Decommissioning Operations group will assume all control and plant operating responsibilities. Once the transition work is complete, the crews' primary responsibilities will be to monitor the SFP and to take any actions necessary to keep the fuel cool and safe. During the first 18 months after shutdown, additional operations personnel will be available to respond to fuel cooling issues to prevent or mitigate a Zirconium fire. After 18 months, the residual decay heat will have cooled sufficiently that a Zirconium fire is unlikely. Operations can then ramp down the on-shift crews to a Technical Specification minimum. The operations staffing levels will remain stable until the spent fuel is packaged and transferred to the ISFSI. Once the transfer is complete, the operations staff will be released.

The cost of staffing for Operations to support license termination is included under Support Staff in Table 4-1. The Operations staffing changes are captured in Figure 4-32 below.

Figure 4-32: Operations Staffing



Maintenance

PG&E has developed a list of critical components that will require maintenance after each unit shutdown. Site Maintenance Support requires sufficient staff to respond to repair requests and keep the site in good working condition and maintained to a safe level. Managing this crew requires effective time management, proper use of equipment to prevent environmental incidents, and prevention of property damage and bodily injury when equipment or heavy loads are moved. The decommissioning maintenance team will be formed under the leadership of a qualified Fix-It-Now (FIN) Supervisor. The FIN Supervisor will review and assess the critical components list and the procedures and processes needed to maintain the equipment. Subordinate staffing will be in place for unit final shutdown. In addition to maintaining the critical components, the FIN Team will be tasked with transition activities including:

- Supporting defueling the reactors
- Reinstalling the reactor vessel heads
- Draining oils and hydraulic fluids from systems that are no longer needed
- Disposing of the used oils and hydraulic fluids
- Draining and processing water from pipes and tanks
- Disposing of processed water
- Verifying tagging and lock-out of unneeded electrical components
- Completing any other tasks to place the two units in a decommissioning configuration

The workload is expected to start abating within about six months of Unit 2 shutdown. Staffing levels are expected to decline about 30 percent from the peak once both units are in their decommissioning configuration.

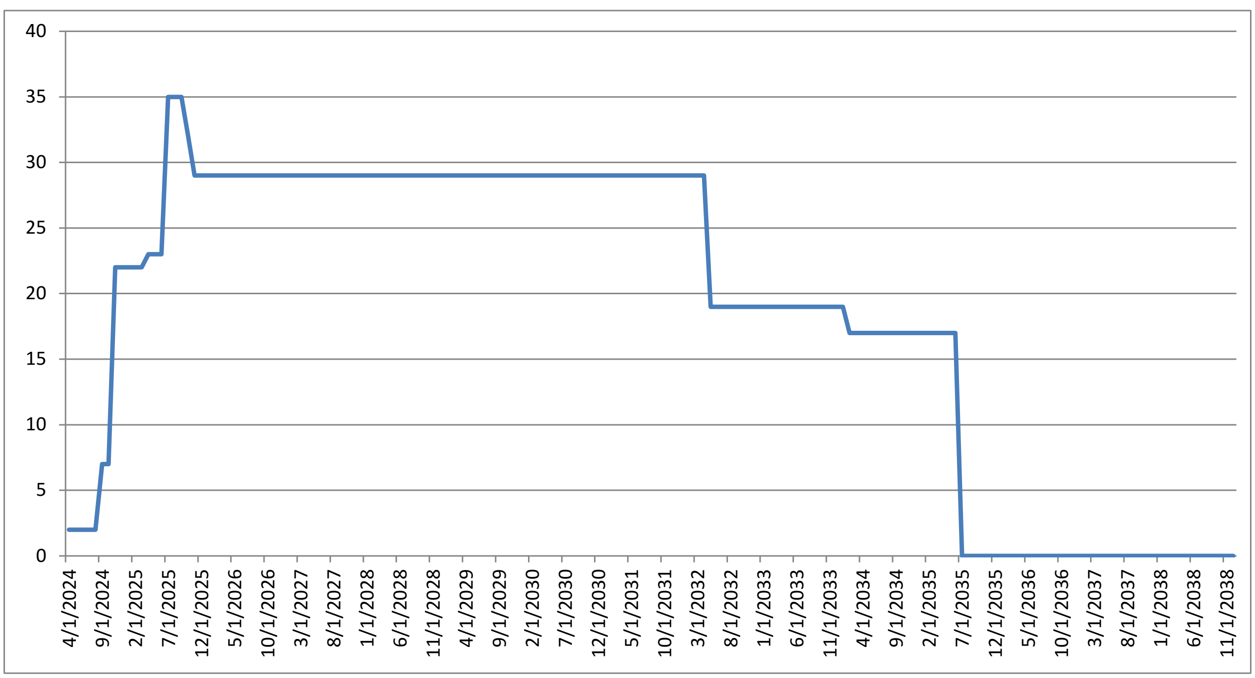
In addition to maintaining critical components, the maintenance staff will perform more routine types of tasks such as:

- Maintain non-critical plant equipment deemed necessary for decommissioning
- Maintain ISFSI equipment
- Operate forklifts for material moves
- Perform general HVAC maintenance and upkeep

The need for the critical components should end when the last of the fuel is packaged and sent to the ISFSI; after that, two-thirds of the FIN team will be released. The remaining FIN team members will continue to maintain any ancillary equipment until building demolition is completed; at that time, the rest of the FIN Team will be released.

The cost of staffing for Maintenance to support license termination is included in Support Services in Table 4-1. The Maintenance staffing is captured in Figure 4-33.

Figure 4-33: Maintenance Staffing



4.1.1.9.5.1. Facilities Maintenance

The Facilities Maintenance group is responsible for keeping the site in a livable fashion that includes:

- Cleaning and maintaining common areas
- Performing "handyman" activities for PG&E-occupied facilities
- Fixing doors—locks, hinges, closers, etc.
- Replacing broken window glass
- Painting
- Setting up, moving, and maintaining desks, shelving, cabinetry, file cabinets, and other office furniture
- Tree trimming and brush removal

Facilities Maintenance costs are based on HBPP Decommissioning and DCPP actual costs. Facilities Maintenance includes contracted labor services, material and equipment provided to the various groups overseeing the decommissioning project.

The Facilities Maintenance group will be staffed when both units are shutdown and will remain steady until building demolition completed.

The cost of staffing for Facilities Maintenance staff is included in Support Services in Table 4-1.

4.1.1.9.6. Radiation Protection

The RP staffing, which provides direct support for discrete projects, is accounted for in the project cost estimates. This section pertains to RP staff that provide support for the site in general (non-discrete). The RP organization that is non-discrete is divided into six functional areas:

- Field oversight coverage
- Chemistry
- Dosimetry
- Count room and effluents
- Instrumentation and respiratory protection
- ALARA and decommissioning job coverage

Gradual ramp-up of the full RP organization is expected to begin in 2023 to support the planning effort and to prepare the procedure and program changes that will be needed to support decommissioning. The full RP complement is expected to be on board when Unit 2 enters final shutdown.

Field oversight RP coverage is responsible for radiological work that supports operations, fuel management, and maintenance of Units 1 and 2 and the ISFSI structures, systems, and components. These activities include work such as routine surveys, job coverage of Operations and Maintenance personnel, RP support for ISFSI operations and maintenance, and Technical Specification and ODCM required radiological surveillances. Field oversight will remain at full complement until after the SNF and

GTCC are transferred to the ISFSI; after that, the group will gradually ramp down as the workload decreases. The last of the oversight group will be released after FSS is completed.

The ALARA group consists of a mix of ALARA engineers and technicians who are assigned to evaluate planned work for expected radiological conditions, estimate the dose rates and total dose for the work, propose techniques or equipment to reduce dose rates and total dose, and develop all supporting documentation. The group will remain intact until all systems have been removed. With the removal of residual plant systems, the radiological hazards will be greatly reduced -- reducing the need for robust radiological analyses and oversight provided by the ALARA group. The group will be released after the systems removal is completed.

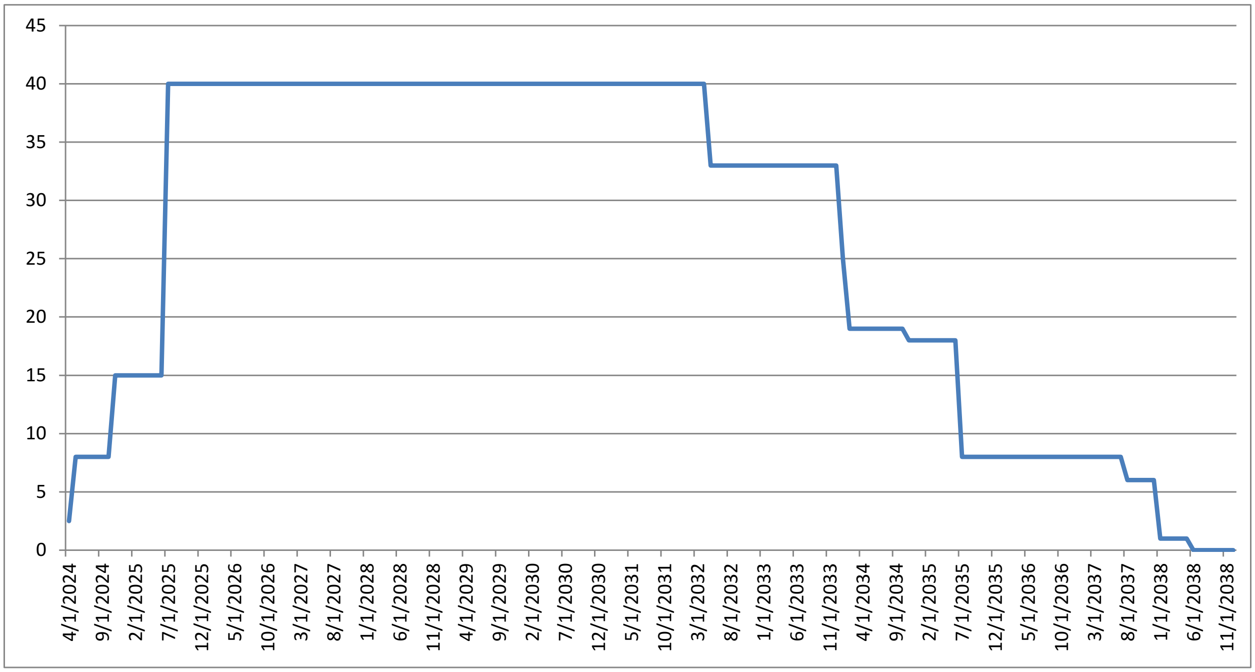
The dosimetry staff provides coverage for the personnel working in the radiological areas and RP personnel who will require dosimetry monitoring. Dosimetric monitoring includes thermoluminescent dosimeter (TLD) issuance and periodic change-out; special dosimetry such as extremity monitoring; access control to ensure that personnel have the correct dosimetric devices and are aware of the radiological requirements for area entry; and bioassay measurements such as whole-body counting. The dosimetry group will remain at fully staffed until systems removal is completed. With the removal of residual plant systems, the radiological hazards will be greatly reduced, resulting the need for dosimetry and access control. The group will undergo a gradual ramp-down until building demolition is completed; after that, the requirements for dosimetry and access control will be eliminated.

The Count Room and Effluents Monitoring functions include both radiological evaluation of in-plant survey results for the protection of employees and evaluation of environmental samples (low background) for the protection of the public and environment. As with the dosimetry group, the radiological drivers for count room and effluent monitoring will be eliminated after building demolition and the staff will be released.

The Instrumentation and Respiratory Protection function is to maintain, clean, repair, and calibrate radiological equipment used in the field. This group will remain in place until after the Part 50 licenses are terminated. Once the radiological conditions are met to terminate the licenses, the need for most radiological instrumentation will be eliminated, and the group will be released.

The cost of staffing for non-discrete RP is included in Support Services in Table 4-1. The RP staffing changes are shown in Figure 4-34 below.

Figure 4-34: Radiation Protection Staffing



4.1.1.9.7. Final Status Survey

To terminate the 10 CFR 50 licenses in the license termination phase, the entire area of the PG&E property must be systematically surveyed, and records generated for submittal to the NRC. The degree of effort in the surveys varies from low in outlying areas to very high in the affected areas of the units and adjacent areas. A systematic approach to conducting the surveys and generating the records starts with the development of a survey plan. This plan identifies the radiological surveys to be performed after decontamination activities are completed and is developed using the guidance provided in the MARSSIM. This document incorporates the statistical approaches to survey design and data interpretation used by the EPA. It also identifies state of the art, commercially available instrumentation and procedures for conducting radiological surveys. Use of this guidance ensures that the surveys are conducted in a way that provides a high degree of confidence that applicable NRC criteria are satisfied. Once the survey is completed, the results will be provided to the NRC in a format that can be verified. The NRC will then review and evaluate the information, perform an independent confirmation of radiological site conditions, and make a determination on final termination of the license.

The Final Status Survey process begins with a total site assessment and characterization. The assessment includes a detailed review of records to determine where any spills or other forms of contamination may have occurred. Once completed, some areas of the full site may be identified for early survey and release. To begin this process early, LTP experts led by a supervisor are scheduled to start the research process in February 2026. The advantage to an early start and an early release of a portion of the property is that the work can be done methodically and can guide the survey crews to learn the unique characteristics of the site while surveying low impacted areas. Higher impacted areas will require more decommissioning effort prior to beginning the survey processes.

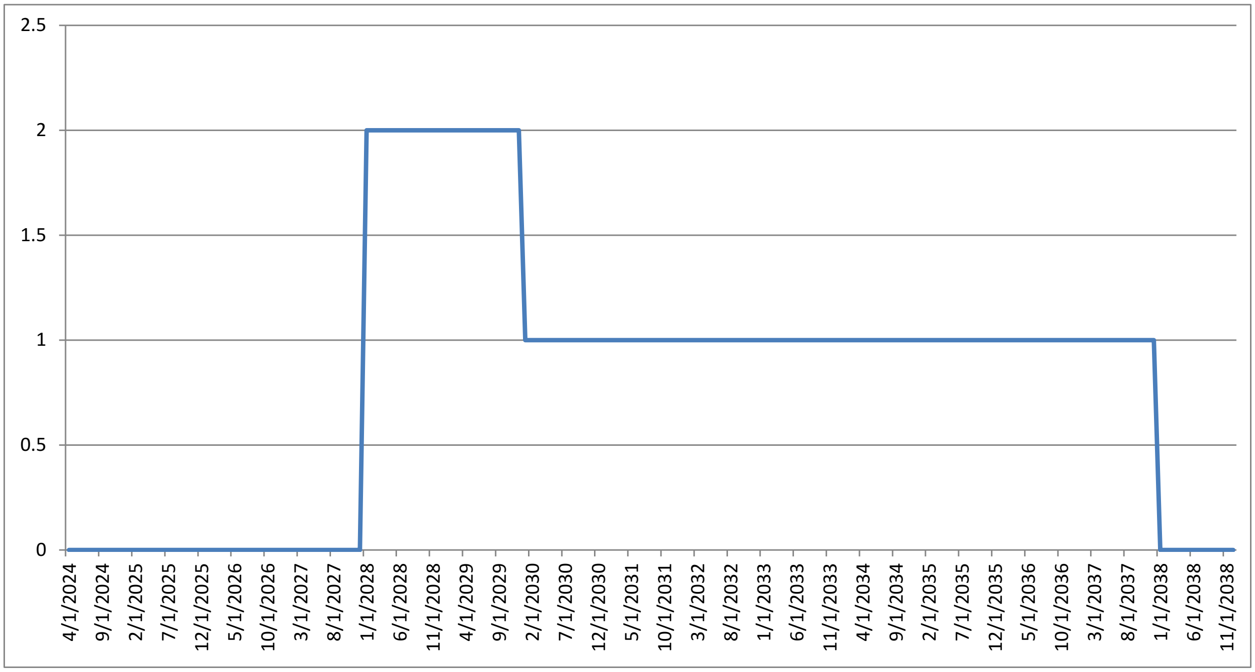
The LTP experts should be ready for FSS support about 2.5 years after final shutdown of Unit 2 when the initial survey team of supervisors, engineers, report writers, and technicians arrive at the site. Once the large component removal work is completed, the FSS team can start surveying inside buildings to confirm that the OAD requirements have been met. At that point, the workload is expected to increase, and the survey team will be expanded.

As OAD is completed, below-grade excavations must have the below-grade surface surveyed before being backfilled. Any soils from excavations also must be surveyed to the same standard as the area from which they came before they're allowed for on-site reuse. All the records of the surveys and analytical results from thousands of samples must be compiled into data packages, with reports, for NRC approval. In addition, the NRC and an NRC-selected contractor will request access to visually confirm FSS activities and verify that results meet all requirements established for termination of the site's licenses.

After all surveys and site restoration are essentially completed, PG&E must generate a summary report on the overall FSS results, comparing the data to the guidelines established in the NRC-approved LTP. Along with this report will be a request for termination of the license issued by the NRC pursuant to 10 CFR 50 licenses for DCPP Units 1 and 2, using the data in the report to substantiate that the site is within the license termination criteria established by the NRC. The LTP experts will be released about one month after the Part 50 licenses are terminated and the FSS group will ramp down to a smaller compliment to finish any reports, answer RAIs from the NRC, and demobilize equipment. The FSS group will be released about one month after the FSS is completed.

The cost of FSS staffing is included in Support Services in Table 4-1. The FSS staffing changes are shown in Figure 4-35 below.

Figure 4-35: Final Status Survey Staffing



4.1.1.9.8. Security

10 CFR Part 73 requires "…the establishment and maintenance of a physical protection system which will have capabilities for the protection of special nuclear material…" At DCPP, the special nuclear material is primarily in the form of spent nuclear fuel. In addition to the regulatory requirement, the security force at DCPP provides for asset control to prevent theft of company property, general control of site support functions such as general vehicle access control to company property, and control of personnel access to areas that do not contain special nuclear material but may contain significant quantities of radioactive materials that could be used for nefarious purposes. The details of the security force efforts and ramp-up/ramp-down of staff are discussed in Section 3.4.

4.1.1.9.9. Safety

The Safety organization is responsible for two main functions -- overseeing implementation of the PG&E Safety Program and Fire Protection Program for the site.

A Fire Protection program is required by 10 CFR 50.48:

> (a)(1) Each holder of an operating license issued under this part or a combined license issued under part 52 of this chapter must have a fire protection plan…

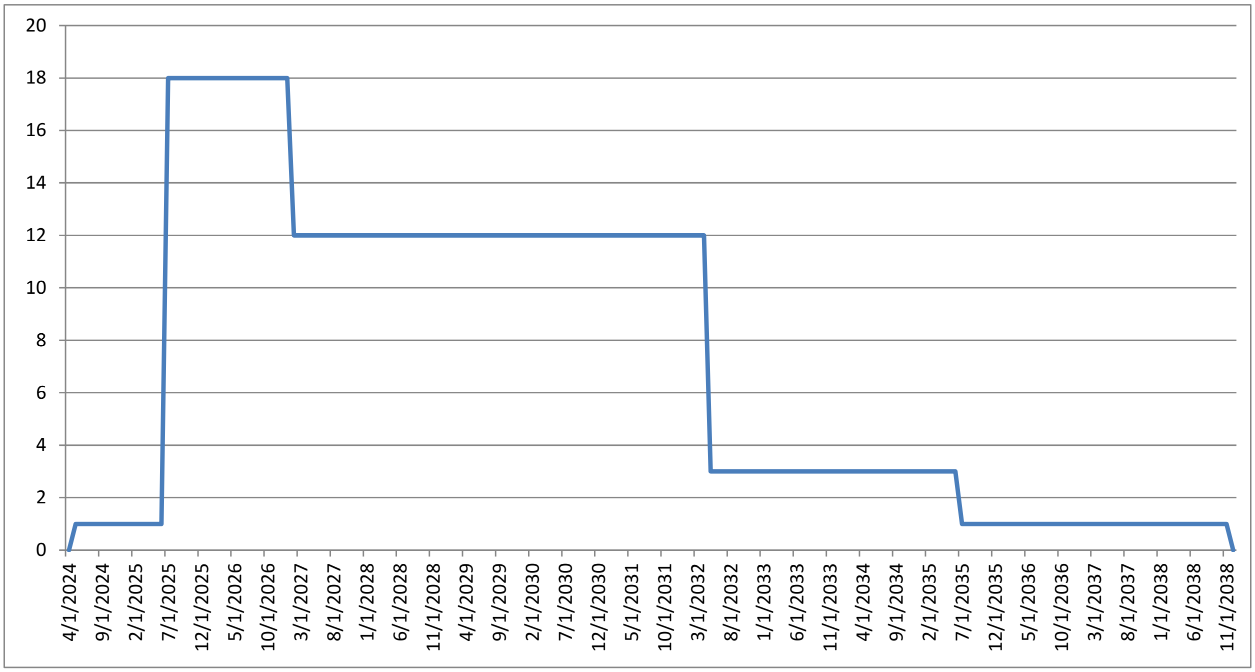
Due to the long response time from a local fire department, the current Fire Protection Program calls for an on-site fire brigade. The Fire Brigade will be transferred from the operating facility to the decommissioning organization when Unit 2 enters final shutdown. The Fire Brigade staffing that is transferred will consist of fire captains and brigade members who will post teams on-shift continuously. The Fire Brigade will be responsible for fire response, confined space rescue, and on-shift medical response. The Fire Brigades' equipment will continue to be maintained, fire extinguishers will be charged, and supplies and consumables will be provided as required. One additional Fire Protection support person will remain available on the day shift to inventory and order supplies, revise procedures, and assist other decommissioning personnel with questions about the Fire Protection Program. Revisions to the Fire Protection Program that potentially reduce the effectiveness of the program require NRC approval before implementation.

Because the fire loading at the plant will be significantly reduced after the zirconium fire risk subsides, the fire brigade will be reduced commensurate with the reduction in risk. The Fire Brigade will continue to follow an on-shift continuous schedule and provide the team with fire response, confined space rescue, and on-shift medical response. A NCO will be available on-shift to support any firefighting efforts as needed. Once the SNF and GTCC wastes have been transferred to the ISFSI, the fire loading and safety risks will have been mitigated to the point that the Fire Brigade is no longer needed. Any fire or medical response will be attended to under contracts with mutual aid groups. Before reducing or releasing the Fire Brigade, the Regulatory Affairs group will submit the revised Fire Protection Program to the NRC with justifications for eliminating the Fire Brigade. After the Fire Brigade is released, one additional Fire Protection support position will be added to help maintain the portable fire extinguishers, issue hot work permits, and perform field inspections of potential fire producing work. After plant systems' removal is completed, the amount of hot work and the need for fire watches will be greatly reduced, allowing for release of one of the Fire Protection support positions. The other fire protection support positions will be released after building demolitions and license termination are completed.

The rest of the Safety group is comprised of safety professionals and industrial hygienists. The safety professionals will be assigned to oversee implementation of the PG&E Safety Program in the field. Their mission is to ensure that the program's requirements are being adhered to in order to maintain the highest degree of safety for the on-site work force. They also will look for opportunities to increase safety margins and for unanticipated safety hazards or issues. The industrial hygienists will perform sampling and monitor working conditions to verify that the working environment meets the requirements of the safety program and any pertinent regulations (e.g., asbestos, temperatures.) The safety professionals and industrial hygienists are expected to be needed until completion of building demolition; after that, most will be released. The remaining safety professional will continue their monitoring duties until site restoration is completed.

The cost of Safety staffing is included in Support Services in Table 4-1. The Safety staffing changes are shown in Figure 4-36 below:

Figure 4-36: Safety Staffing



4.1.1.9.10. Procedure Writing

Procedures are the instructions on how work will be performed or programs implemented. The current operating procedures may or may not meet the need for safe implementation of work at a shutdown facility. Many currently active procedures will no longer be required and will be retired. The remaining active procedures will likely need to be revised to reflect the shutdown condition. New procedures that address specific shutdown conditions will need to be written. The total procedure population will need to be evaluated at several milestones including unit final shutdown, completion of fuel and GTCC transfer to the ISFSI, completion of license termination, and completion of site restoration.

During the planning process, decommissioning procedures will be developed to reflect the reduced risk associated with decommissioning activities. A lesson learned from decommissioning at Big Rock Point in Michigan is that the culture change from an operating plant to a decommissioning project can be challenging. To facilitate the cultural transition, Big Rock Point replaced operating plant processes with non-nuclear, corporate, or industrial safety processes.

The DCPP decommissioning organization will adopt a similar approach to de-nuclearize and/or streamline decommissioning procedures. A graded approach will be used to determine the content and level of detail for decommissioning procedures. For example, decommissioning procedures associated with low risk activities (e.g., removal of non-radiological equipment) will be simplified compared to procedures for conducting important-to-safety activities (e.g., SFPI design). In cases where the decommissioning requirements are similar to operating plant requirements, existing DCPP procedures will be used in lieu of developing decommissioning department procedures (e.g., accident analysis).

The decommissioning procedures will be developed to match the needs of each phase of decommissioning. As decommissioning progresses, programs and procedures will continue to require updating or elimination to be consistent with the decommissioning status of the plant.

Impacted programs and procedures will be identified in conjunction with the revisions to licensing basis documents. These programs and procedures will be developed in parallel to the NRC review and will be available for use within 30 days of NRC approval of the licensing basis documents. Authors of the revised licensing basis documents will be involved in the program/procedure revision process to ensure that the revisions accurately implement the licensing basis changes and do not require revision after NRC review and approval of revised licensing basis documents. Examples of procedures that may need revision early in the process include:

- Revising and updating licensing basis documents
- Calculations
- Licensing Basis Impact Evaluation
- Quality Assurance (QA) audits and surveillances
- Employee concerns
- Regulatory reporting
- QA records
- Commitment management

Prior to permanent shutdown, the list of program documents and procedures will be reviewed to identify the program documents and procedures that require a revision, cancellation, or new procedure to support decommissioning activities. The cost of this effort is discussed in Section 4.1.1.1.1. The focus of program and procedure changes after permanent plant shutdown will be de-scoping the operational aspects of the plant and creating new programs and procedures for decommissioning (e.g., identification of active and inactive systems, operation, and maintenance of re-purposed equipment). For example, outage procedures may be eliminated after permanent shutdown, but reactor engineering procedures will be reduced after defueling. Once major decommissioning begins, new procedures will be needed to control and implement decommissioning-specific activities (e.g., methods to decontaminate, dismantle and remove SSCs, FSS). Additional programs and procedure changes will be needed after defueling.

Plant programs and procedures impacted by permanent shutdown will be identified and revised to reflect the reduction in risk associated with the permanent shutdown of most plant safety systems and subsequent decommissioning activities. The Procedure Manual will be reviewed to identify additional procedures impacted by planned decommissioning activities. Changes to programs and procedures will be logically tied to specific decommissioning activities to ensure availability when needed and to minimize project delays.

In addition, new procedures also will be developed to implement decommissioning activities that were not required during plant operations (e.g., cold and dark, CFH training program). New and revised plant programs and procedures should be based upon revisions to licensing basis documents and reflect changes to the accident analysis, Q-List, regulatory commitments, and other regulatory requirements. Examples of the types of programs affected include the following:

- Procedures that implement NRC requirements that are no longer applicable or have limited applicability to a permanently shutdown plant (e.g., Reactor Oversight Program, Fukushima, Maintenance Rule)
- Programs and procedures impacted by changes to the Part 50 licenses to revised licensing basis documents (e.g., accident analysis, commitments, reclassification of SSCs and activities that are no longer safety related)
- Programs and procedures that are no longer applicable to a permanently shutdown and/or defueled plant (e.g., maintenance and test procedures for SSCs that are no longer in service)
- New programs and procedures for decontamination and dismantling activities (e.g., cold and dark, CFH training program, management of GTCC waste)

Although some existing procedures used during operations will continued to be used after permanent shutdown (e.g., ALARA, environmental permitting, spill response), some procedures may be eliminated, changed, or developed. Procedures that may be eliminated include:

- Select operations, maintenance and test procedure associated with equipment that is no longer in service
- Surveillance procedures associated with TS that were eliminated
- Outage and selected reactor engineering procedures
- Procedures that implement regulatory requirements that are no longer applicable (e.g., license renewal, reactor oversight program)

Examples of procedures that may be reclassified or de-scoped include:

- Work control
- Emergency procedures to reflect revisions to the accident analysis
- Security procedures to reflect the change in the design basis threat for decommissioning
- Administrative procedures to streamline and reflect inherent risk reductions (e.g., corrective action program, design controls for removing inactive systems)

Examples of new procedures that may be needed include:

- Interface control
- RAIs
- Operations procedures that address how critical equipment will be operated during decommissioning
- Maintenance procedures for decommissioning equipment
- Changes to the way that equipment is operated

- Operation and maintenance of re-purposed operational SSCs (i.e., used for decommissioning activities)

Industry experience shows that decommissioning plants that were proactive in restructuring their Plant Manual to eliminate procedures that were no longer required and reclassify procedures that were no longer safety significant were able to reduce the regulatory burden and risk associated with noncompliance. In addition, reductions in the level of effort for maintenance, training, and staffing associated with implementing these programs and procedures were immediately realized.

The cost of the procedure efforts is included in Support Services in Table 4-1.

4.1.1.9.11. Training

Safety is the core of the culture at DCPP, and an excellent safety record is the foundation of success. Every employee is empowered and expected to contribute to a safe work environment. A critical attribute of a safe operating organization is that the organization is well trained. DCPP has already implemented an extensive training program and compliance tracking database to ensure worker safety and compliance with CalOSHA. Personnel who enter the plant site to conduct work are provided training commensurate with the hazards they are expected to encounter, determined by their job assignment and site access requirements. Training may be accomplished through any of the following:

- Formalized classroom lecture(s)
- On-the-job training
- Tailboard briefings
- Video/DVD
- CBT (Computer-based training)
- Handouts to read as sign
- Vendor training material

Personnel are qualified when the documentation of course completion is verified. All personnel working at DCPP generally need to have the following required training:

- Fire prevention
- Work control process
- Confined space requirements
- Clearance procedures, and lock out/tag out
- Fall protection (including ladders and scaffolding)
- Overhead drop prevention
- Hazardous materials handling
- Tailboard requirements

In addition to General Employee Training (GET) and RadWorker training, Hazardous materials training (HAZWOPER), Asbestos Worker, and Storm Water Pollution Protection training, some additional training may be required in accordance with the worker classification. Some work functions require additional training to gain full qualification. Special training programs are administered for positions such as Radiation Protection Technician and Certified Fuel Handler.

Some of the decommissioning work force will have obtained training, qualification, and experience at previous places of employment. Further, some job classifications that are procured under specialty and project contracts will require that the vendor provide a training and qualification pedigree that the Training organization can review to determine if training waivers may be granted. For example, contracts will require that the vendor providing asbestos abatement services provide personnel who are asbestos abatement technicians (or similar title) and will, therefore, not require training at the site in asbestos abatement.

Decommissioning activities present new risks and challenges, and new training requirements will be regularly implemented by PG&E to reflect the necessary requirements for nuclear decommissioning. New procedures must be created for recurring, routine, or complex decommissioning activities that require standard controls and a higher level of training. A training matrix will be constantly modified to reflect the current status of qualifications to ensure personnel protection.

Because the types and scopes of work undertaken to plan and execute decommissioning differ from those typically used at an operating plant, staff training on the changes to assigned tasks and new tasks is needed to ensure an effective and efficient transition into decommissioning. PG&E's early evaluation of the skills and knowledge needed to implement the new and modified tasks will help early training development to support on-time training and qualification.

The degree of rigor for training processes for permanently shutdown plants is much less than for an operating plant. Precedent exists for decommissioning plants that seek relief from the 10 CFR 50.120 training rule and Training Program Accreditation authorities. The training organizations typically cancel accreditation of the training programs and revise training processes and programs to implement those more suitable to decommissioning.

The training staff needed to support the transition from power operations to decommissioning will be seconded to the Security organization. The training staff will be focused on:

- The continued training and qualification of security officers needed to protect and control access to the shutdown unit(s)
- Training procedure revisions
- Revision or elimination of existing training programs
- Creation of a new CFH training program

The existing operational training organization will continue to maintain the current training programs, such as Licensed Operator Training and GET, for the operational units. The Decommissioning training organization will begin to assume training implementation responsibilities as the Unit 1 shutdown approaches and will fully own all training shortly after Unit 2 shutdown. The cost of training is shown in Section 4.1.1.9.7

4.1.1.9.12. Regulatory Management

Managing interactions with regulatory agencies such as the NRC and the CCC are important to ensure that all stakeholders have a common understanding, all requirements are met, and any issues are identified early and resolved before the issue creates safety, schedule, or cost perturbations. Regulatory changes will be required at multiple milestones throughout the decommissioning process. Managing the interactions is a coordinated effort by personnel with expertise in licensing issues, permitting, legal, and emergency preparedness.

10 CFR 50.82 requires several regulatory submittals for a licensee that is transitioning from normal operations to decommissioning. To support decommissioning planning and activities, specified amounts of the NDT are available prior to and after permanent shutdown for decommissioning planning. The goal is to identify and prepare the required regulatory submittals to facilitate seamless execution of decommissioning activities and ensure access to the NDT available limits. Informed and effective planning benefits include:

- Reduced costs associated with NRC review and acceptance of licensee submittals
- Reduced operation and maintenance costs associated with plant activities that are no longer required after the plant is shutdown (e.g., certain safe shutdown SSCs)
- Reduced regulatory burden associated with exemptions for regulations that are no longer required (e.g., maintenance rule)
- Reduced plant risk profile because several accident scenarios and plant hazards are no longer credible

To help timely approval of submittals, communications pathways should be established early with the NRC. The cognizant manager will be instrumental to promoting communications to ensure that the NRC and PG&E have a common understanding of which submittals are needed; the duration of the NRC review and approval period; the timeframe that PG&E needs the NRC's approval to continue making progress with decommissioning; and the status of any submittals currently under review.

Lack of timely submittals may result in decommissioning schedule delays. These delays are primarily associated with NRC acceptance and review of submitted exemption requests, license amendment requests and/or changes to licensing basis documents. Although industry experience indicates that the NRC review time on average is 18 to 24 months, the NRC review times could exceed 24 months if the current NRC staffing levels remain constant considering the planned increase in the number of nuclear plants to be decommissioned over the next decade.

Work on exemption requests, license amendment requests and changes to licensing basis documents will start to prepare for an early submittal. Documentation to support any NRC-required approvals are expected to be submitted at least two years before the changes need to be implemented. The goal of early submittal is to allow sufficient NRC review and approval time so that NRC approval is concurrent with issuance. Changes to multiple licensing basis documents will be submitted to the NRC at the same time for similar changes to take advantage of coordinated NRC reviews. The significant changes that will require NRC approval include:

- Technical Specification changes at each final unit shutdown
- Emergency Preparedness Programs changes at the end of the zirc-fire window
- Staff reductions after completion of fuel and GTCC transfer to the ISFSI

Licensees that do not allow time to plan decommissioning activities or that stagger the submittal of exemption requests and changes to licensing basis documents often experience longer NRC review times and costs. In addition, delayed submittals or prolonged NRC review times could potentially impact achievement of desired NDT milestones. The cost of this effort is discussed in Section 4.1.1.1.1.

The NRC requires the following regulatory submittals for plants that have decided to permanently shutdown:

- 10 CFR 50.82(a)(1)(i): Certification of permanent cessation of power operations (Within 30 days of the licensee publicly announcing the date the facility will permanently cease operation)
- 10 CFR 50.82(a)(1)(ii): Certification of permanent (nuclear) fuel removal (no time limit)
- 10 CFR 50.82(a)(4)(i): PSDAR (prior to or within two years following final shutdown)
- 10 CFR 50.75(f)(3): DCE (within five years prior to final shutdown)
- 10CFR 50.54(bb): Irradiated Fuel Management Plan (within two years following permanent cessation of operation of the reactor or five years before expiration of the reactor operating license, whichever occurs first)
- 10 CFR 50.82(a)(8)(iii): site-specific DCE (within two years of final shutdown)
- 10 CFR 50.82(a)(9)(i): LTP (at least two years prior to the expected license termination date). Although the LTP is not required until several years after permanent shutdown, the HSA should be completed prior to reducing staff who have knowledge of the plant's history of prior events.

Additional submittals that reflect the defueled status of the plant include:

- License amendment requests
- Exemption requests
- Licensing basis documents (LBDs) (multiple submittals may be required as decommissioning progresses)

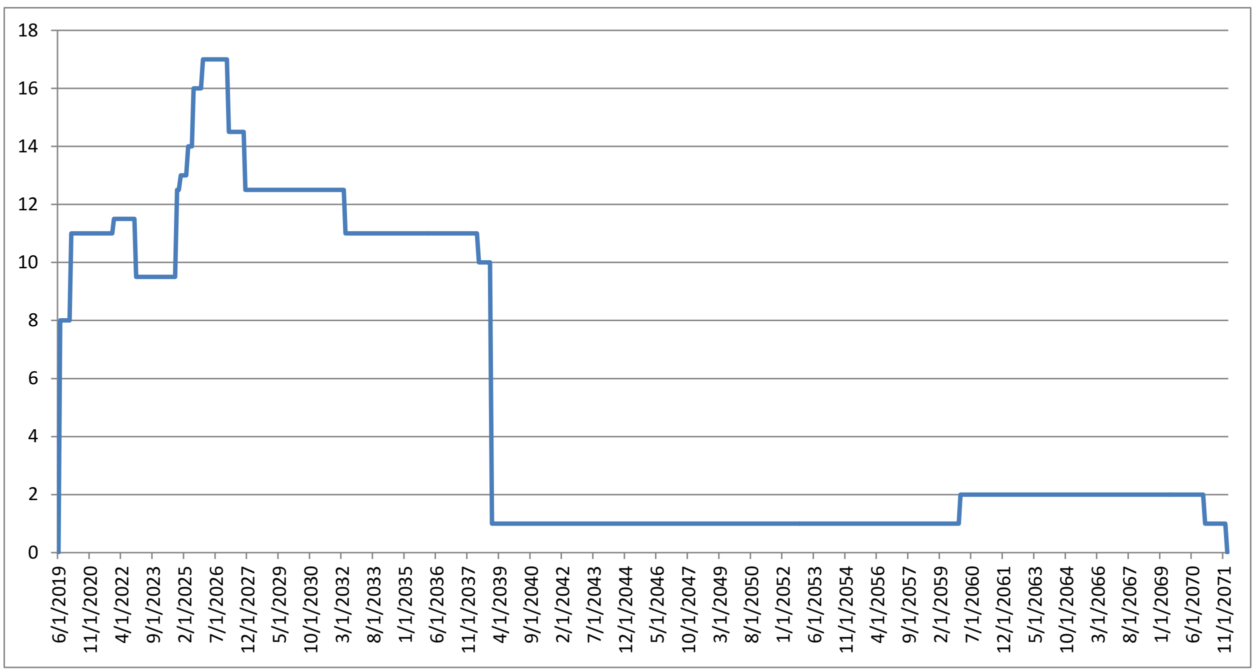
Updates to design and technical documents, such as calculations and analyses will also be required to support these submittals.

Permitting requirements are in addition to regulatory requirements and are focused on ensuring that the work activities are accomplished in a way that protects the work force, the public, and the environment. Many of the work activities for decommissioning require prior authorization from governing bodies. The planning activity for this effort identifies and details the steps necessary to obtain permits before work begins. The permitting strategy can be found in Section 3.1 and establishes anticipated permits, permit phasing, and submittals, and identifies the recommended lead agency. The permitting team will pursue each of the necessary permits.

Regulatory management staff will be in place when Unit 1 enters final shutdown and will ramp up slightly to accommodate any needed revisions to LBDs, licenses, and permits. Staffing levels will remain relatively stable over time and vary by one person as the work load is reduced. The group will have a major ramp-down after site restoration is completed. One part-time position will be available for the duration of the project to assist the ISFSI with any revisions to regulatory required programs, LBDs, licenses, and permits.

The cost of Regulatory Management staffing is included in Support Services in Table 4-1. The staffing changes are captured in Figure 4-37 below.

Figure 4-37: Regulatory Management Staffing



4.1.1.9.13. Permit Preparation and Agency Reviews

In addition to the PG&E permitting team, contractors will assist in the accurate and timely preparation, processing, and completion of permit conditions that are critical to the start of execution activities and the completion of license termination. Contractor activities include data collection; the completion of environmental studies; development of a project description; development of application documentation; environmental impact assessments; the fulfilment of permit conditions; and conducting environmental compliance monitoring and reporting, depending on the permit. Costs associated with discretionary permit mitigations are currently unknown and will be determined as part of the permit application and CEQA processes. As a result, these costs are not included in the permitting cost estimates.

Applicable activities have been identified for each permit; the related costs for major discretionary and environmental permits are estimated based on a combination of benchmarking of similar projects, subject matter expertise, and experience.

In addition to these contractor labor costs, some agencies charge an agency review fee that is a labor-based fee depending on the amount of review time required by the agency to review and process the permit. These are not set fee amounts. Each estimated agency review rate has been determined for major discretionary and environmental permits through either published rates or benchmarking from previous reviews by the agency. Similarly, the anticipated agency review times were estimated through the benchmarking of similar permit reviews.

The permit contractor labor and agency review costs have been evaluated for applicable work scope covered across license termination, spent fuel management, and site restoration. Based on the assessment, one-third of the permitting contractor labor and agency review costs have been applied to license termination.

4.1.1.9.14. Specialty Contracts

The Specialty Contracts scope encompasses maintenance of the site infrastructure that will accommodate the decommissioning team through the duration of the decommissioning project and general support to both PG&E and vendors performing their specific scopes of work. The Decommissioning Tools, Equipment, Supplies and Specialty Contracts Study provides the necessary evaluation of these needs through decommissioning.

The Special Contracts scope will identify the need for vendors and consultants to perform work that is not included in any of the scope specific contracts. This scope will provide laundry services (if applicable) and industrial security forces after SNF is moved to the ISFSI pad; maintain building systems for facilities that remain in use; provide garbage pick-up and janitorial services for the decommissioning team; pay monthly utility charges, water treatment contract charges, compressed gasses charges and fuel used by the decommissioning program groups;, pay emergency planning and NRC Fees, property tax and property and liability Insurance; and fund emergency preparedness participation by non-PG&E organizations.

Tools, equipment, supplies, and specialty contracts will be used throughout the project. Identification of tools, equipment, supplies, and specialty contracts requirements during the early phases of decommissioning also will provide the opportunity for the site to develop appropriate maintenance schedules to ensure safe and proper function of tools and equipment. Many unique tools and made-to-order equipment have long lead times for delivery. Identifying these types of unique items is essential for work planning and meeting critical path milestones, including the need to be available prior to final shutdown. Others will be needed to support unique activities during the decommissioning.

Development of a 'use and acquisition' schedule ensures that tools, materials, and equipment will be available when needed and that funds will not be spent prematurely by procuring materials early and avoiding costly expediting charges resulting from placing orders late. The acquisition schedule will aid in budgeting and NDCTP application preparation by creating an expected burn rate for some of the more unique tools, equipment, supplies, and specialty contracts. The burn rate for the more typical tools, equipment, supplies, and specialty contracts has been established by the following:

- A historical burn rate analysis of HBPP's Decommissioning Project for this category
- Analysis of DCPP site actual costs for similar work activities
- Identification of SSCs that will remain in operation and require maintenance after the final plant shutdown
- A staffing estimate for decommissioning activities
- Identification of tools needed to support decommissioning activities to ensure the items are available when shutdown occurs
- Planning for material procurement

As the project begins, actual expenses can be balanced against the forecast burn rates.

In addition to benchmarking and historical cost analysis at HBPP, DCPP, and SONGS, a thorough review of all scope specific plans will be performed to identify any gaps or exclusions from scope that has not been budgeted. These gaps are vetted through the plan lead. Then a specialty contract is estimated and included in this plan to ensure a complete decommissioning scope with no overlapping or omitted work scopes.

Provisions for tools, equipment, supplies, and specialty contracts will be handled accordingly, based on the contracting strategy. Scope specific vendors will plan and procure materials for their associated scope of work. PG&E self-performed scope activities are estimated and included in this section.

4.1.1.9.14.1. Facilities, Garbage, and Janitorial

<u>Facilities</u>

Tools, Equipment and Supplies include:

- General Tools and Equipment: General tools of varying sizes such as wrenches, hammers, screw drivers, and drills, as well as electrical equipment, carpentry materials, various cutting equipment, replacement blades, pipe fitting tools, hoses, global positioning system, communications radios, unique equipment rental, personal protective equipment, contamination control provisions, various lab supplies, contamination detection instrumentation, waste shipping containers and other similar materials

- Specialty Tools and Equipment: Tools and equipment typically used for specific projects and/or activities that are complex and/or categorized as high risk. Specialty tools and equipment may be made-to-order or require customization to meet project needs.
- Health Physics Supplies/RP Tools and Equipment: Air samplers, HEPA ventilation systems, radiation detection instrumentation (count room and field instruments), Visqueen, sample containers, radiation personal protective gear, rental of Respirator Wash Facility, as well as other items to help control the spread of contamination and protect the public health and safety. This category also includes small systems such as ISOCS, Apex gamma equipment, Laboratory Sourceless Object Calibration Software (LabSOCS) system maintenance, and various specialized equipment/parts as necessary, Tri-Carb® 3110TR, (a computer-controlled benchtop liquid scintillation analyzer), polymeric barrier system, Sentinel software suite program (a comprehensive Radiation-Protection Management Software System), Respirator Wash Facility, miscellaneous items used for contamination control and general site maintenance.
- Services, Supplies, and Consumables: Recurring costs associated with essential services to support the decommissioning staff include site operation and maintenance services, general office supplies, insurance costs, plant energy, property taxes, NRC fees, emergency planning fees, environmental sampling analysis, janitorial services, landscaping services, building maintenance services, portable toilet rental and maintenance, temporary lighting and trash and refuse collection. Also included are services for parking lot striping and maintenance, signage, furniture rental, employee travel for training, communications services, and Industrial Security services, as well as services provided by vendors with scopes of work and costs that fall outside of the major project scopes.

Specialty contracts include consultation services beyond regular staffing and will be required to manage the disparate activities and needs. Consultation services are provided by companies and individuals who have the expertise in the specific activity or requirement. Examples of the services that will be needed include:

- Project oversight of SME consultation services
- On-site emergency medical care via remote physician
- Heating, ventilation, and air conditioning maintenance and repair
- Elevators, sanitary lift station maintenance and repair
- Development of waste management disposal strategies
- Legal representation in support of the NDCTP and CPUC proceedings
- Support for updating specific project plans and procedures as needed
- Final Site Survey consulting services and sample analysis
- Development and oversight of a decommissioning specific Storm Water Pollution Prevention Plan
- Annual certification for the Turbine Building and Cold Machine Shop overhead cranes
- Remove flux thimble tubes from both reactor vessels
- Licensing support for DCGL development, and LTP review and submittal

- RP consultation to downsize the Emergency Plan
- Preparation of site restoration plans, including permitting mitigation plan
- Site insurance and property taxes
- Support for design and restoration planning
- Other services to support emerging requirements and issues

Garbage

- Trash and recycling service will be provided to the site, similar to current services. Dumpsters will be provided for trash and recycling materials with pickups scheduled as needed. Containers also will be provided for battery and lightbulb disposal, with an appropriate pickup schedule. Costs for trash services are expected to be proportional to the site staffing levels.

Janitorial

- Janitorial services will be provided by Facility Maintenance personnel. They will be employed to clean permanent toilet facilities, breakrooms, and offices space. This service also will empty trash and recycling containers and dispose of refuse in the dumpsters provided. The cost of these services is expected to be proportional to the site staffing levels.

4.1.1.9.14.2. Utilities

Utilities are provided to continue the operation of required plant systems, to power the building systems required for habitability and to support the decommissioning process.

The current utility systems, both above and below ground, will be modified, re-routed, and maintained to provide essential services to the site. These utilities include electricity, compressed and liquid gasses, service and domestic water, and sanitary services.

Electricity

A new temporary system (see Section 4.1.1.2) will distribute power as required, using new and existing electrical systems. The estimated electrical load is 10 MW. The Cold and Dark Plan will install this temporary system and the metered electric consumption will be funded here.

Compressed Gasses and Liquids

Compressed gasses such as nitrogen and argon will be used for purging existing tanks or systems that may have contained a combustible material, while other gasses, oxygen and acetylene will be used as a fuel for cutting torches, and propane will fuel some mobile equipment such as forklifts. The liquid gasses to be used are gasoline and diesel as fuel for site vehicles, mobile equipment and portable lights, generators, and air compressors. The cost of these gasses is estimated to be approximately equal to the outage monthly costs at DCPP.

Domestic and Service Water

Water, both domestic and service, will be processed through the sea water reverse osmosis (SWRO) system (see Section 4.1.1.2.2). This water will be distributed through existing, re-routed, or new piping systems as required. Costs for the water systems are based on the vendor contract.

Sanitary System

The Sanitary System will combine existing, re-routed, and new piping to collect water from permanently installed kitchenette/breakroom and bathroom facilities to an existing waste processing location. Liquid waste will be treated to acceptable levels, and then discharged to the plant effluent. Solids will be trucked off-site for treatment and disposal. As the demolition progresses, domestic water and sanitary systems will be replaced with bottled water and portable toilet facilities. Costs for the sanitary system are based on the vendor contract.

Site Temporary Accommodations

Site conditions and staffing levels will change throughout the different stages of decommissioning, and accommodations must be provided for personnel in each stage. Staff will be displaced as buildings are demolished to accomplish project goals and accommodate decommissioning needs such as creating haul paths, staging areas, equipment storage, etc. As the site changes, displaced staff will need to be relocated to facilities that contain office space and break areas. To facilitate these changing conditions, some buildings on-site will be repurposed to accommodate staff (see Section 4.1.1.2.2); however, these facilities will need to be supplemented by temporary accommodations.

Temporary accommodations will consist of construction trailers that will be accompanied by portable toilets. The trailers will provide sufficient space to house employees, including break areas, and will include adequate office space, desks and chairs, and space for meetings or tailboards (safety meetings generally conducted on-site prior to a work activity). They will meet applicable fire codes for the number of personnel; have adequate evacuation routes in case of emergency; have adequate access to emergency services such as fire and ambulance; contain lighting, heating, and air conditioning; and be securable to prevent unauthorized access during working and off hours. These facilities will require adequate infrastructure support, including telephone communications, LAN and internet access, HVAC, and electric power.

During open demolition of the power block (see Section 4.1.3.2.1), construction trailers will be provided for crews performing the work. The trailers will be double wide 12’ x 60’ standard trailers and positioned north, south, and west of the power block. Another set of trailers will be located near the ISFSI for the concrete pad extension (see Section 4.1.1.5.1) and Security Building construction (see Section 4.1.1.2.2). Portable toilets will be next to the construction trailers. These facilities will be strategically placed to support the work and personnel performing the work, but they will be located so that they do not interfere with demolition, equipment movement, haul routes, or other decommissioning activities. Care will be taken in siting these facilities to ensure that personnel safety hazards are addressed, and the facilities will be mobile to accommodate relocation as conditions change.

If relocation is required, pre-planning will ensure the facilities are moved to minimize the impact on personnel and ongoing work. Once work is completed in the respective area and temporary accommodations are no longer required, they will be turned over to the Materials Management group to be reused, sold, or disposed of.

4.1.1.9.14.3. Licenses and Fees

DCPP is required to maintain its licenses and permits, pay taxes, and provide insurance coverage until the ISFSI license is terminated. Licensing fees, emergency planning fees, insurance, and taxes are assessed to DCPP annually.

Licensing Fee

The licensing fee is assessed by the NRC; the amount is established in regulatory guidance. The NRC also charges for labor and expenses related to review of plan changes and other documents as well as its participation in public meetings, both in California and in Washington D.C. regarding DCPP.

Emergency Planning Fees

The Federal Emergency Management Agency (FEMA) and the California Emergency Management Agency and with other local and state agencies all impose fees related to emergency planning and emergency response. DCPP incurs these costs annually; the amount is not likely to change until all SNF has been transported to the ISFSI.

In addition, the programmatic staff will be supporting regulatory management, and special contracts will be required to support Emergency Preparedness (EP). The Early Warning Siren System, as well as other EP-related software and equipment, will require maintenance and testing. Local medical facilities as well as city, county, and state governments will incur costs associated with drill participation. Costs for developing, printing, and distributing educational materials for the public are also included in this section which prints and distributes EP information to the public. This section includes the costs of EP-related commitments PG&E made in the Joint Proposal. It is expected that these costs will remain similar while EP drills are required.

Permitting Fees

Most permits require fees to be submitted at the time of application to cover the cost of processing. Details of the permitting strategy as well as identified permits can be found in Section 3.1. The fee for each permit is a set, published amount by the governing agency and has been determined for each expected Major Discretionary and Environmental permit, as applicable. These application fees are different than the labor-based agency review fees that are covered in Section 4.1.1.9.13.

Permit fees have been evaluated for applicable work scope covered in license termination, spent fuel management, and site restoration. Based on the assessment, one-third of the permitting fees have been applied to license termination.

Property Taxes

Property taxes are calculated based on the booked value of the DCPP assets in service. Current capital assets on PG&E's books and records will be fully depreciated to zero by 2026, so they will not add value to the property tax base. Any spending on future tangible personal property used in the decommissioning process will be funded by the NDT. These dollars are generally expensed by the company and will not add value to the property tax base. Current facilities and new facilities related to the dry cask and spent fuel storage are funded by the NDT. These dollars are generally expensed by the company and will not add value to the property tax base. To the extent these dollars are capital dollars spent by the utility, SNF is generally viewed as contaminated property and will contribute little to no value to the property tax base. PG&E (utility) owned land and leased land from Eureka Energy will continue to be used in the same way as it is today until the decommissioning process is completed. The estimated property taxes based on FY 2018/2019 land values and FY 2017/2018 tax rate are approximately $725,000 per fiscal year, July 1 through June 30.

Property and Liability Insurance

Fees are assessed based on the current license condition or EP participation required. Insurance coverage and rates are established by PG&E Corporation and property tax is based on the depreciated value of the assets in service at the time. Property and liability insurance policies and coverage strategies are developed by PG&E Corporation. The corporation has provided premium information based on the current Liability, Nuclear Liability Adjustments, Property, Nuclear Property Adjustments and Government Indemnity Insurance premiums as:

- $6 million per year while the reactor is shutdown, defueled; spent fuel may exceed 565°C and susceptible to cladding fire
- $350,000 per year once fuel can no longer exceed 565°C, fuel is no longer susceptible to cladding fire and significant inventory of mixed radioactive material remains on site
- $250,000 per year when all SNF is on the ISFSI pad or until all casks are transported off-site to an approved, off-site storage facility

4.1.2. Spent Fuel Management

4.1.2.1. Spent Fuel Pool Operations

4.1.2.1.1. Spent Fuel Pool Operations

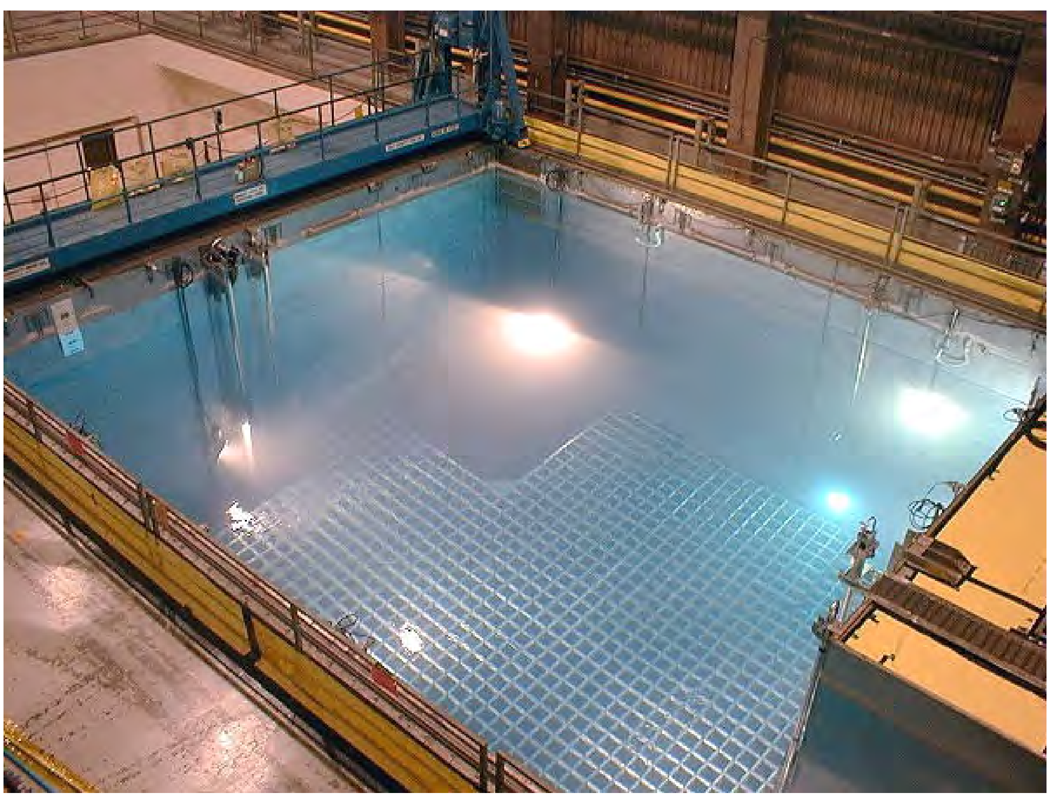
SFP operations primarily consists of the security, equipment operation and maintenance of all SFP equipment that is required to ensure adequate protection of the public health and safety and the environment while protecting and storing spent nuclear fuel (see Section 4.1.1.5.2 for details of similar SFP facility security, operation, and maintenance activities associated with the storage of GTCC waste). All SFP equipment in the FHB must be operated and maintained properly to provide the continuous capability to safely store spent fuel, remove decay heat generated by spent fuel, and provide shielding from the radiation given off by spent fuel. SFP operations also consists of ensuring that the proper procedure, licensing, and permitting changes are implemented; NRC reporting and inspections are performed; specialized equipment is made available; and engineering is performed to support the necessary license revision, procedure revision, security, operations, and maintenance activities.

Nuclear reactor fuel that has been used to the extent that it can no longer sustain a chain reaction is considered depleted and is commonly referred to as spent fuel. Since there are no off-site disposal facilities licensed to receive spent nuclear fuel, all spent fuel must be packaged and stored at the site where the spent fuel was generated. All spent fuel removed from Unit 1 and Unit 2 reactors during the operating life of the plant must remain in the SFPs until the decay heat is reduced to acceptable limits for safe transfer to dry cask storage, otherwise known as a cooling period. While the spent fuel remains in the SFPs, prior to transfer to the on-site ISFSI, its storage must be managed safely at the SFPs. All spent fuel in Unit 1 and Unit 2 SFPs at the time of permanent shutdown is planned to be transferred to the ISFSI for dry cask storage within seven years of Unit 2 shutdown (a total of 1,261 spent fuel assemblies from Unit 1 and 1,281 spent fuel assemblies from Unit 2). For the purposes of this DCE, SFP operations will begin at the time of permanent shutdown of each unit and will continue the entire time that the spent fuel is stored in the SFPs, until it is all transferred to the ISFSI.

The SFPs are located in the FHB, a steel-framed building anchored to the east side of the concrete Auxiliary Building structure (refer to Figure 4-38 and Figure 4-39). The FHB encloses the two fuel handling areas of Unit 1 and Unit 2 and is a shared structure that contains the SFPs, the fuel handling cranes, fuel racks, and related equipment located on each side of the east end of the Auxiliary Building. The SFPs are reinforced concrete structures 40-ft. deep, 35-ft. wide, and 40-ft. long containing approximately 430,000 gallons of borated water. The SFP concrete is 6-ft. thick, with a stainless steel plate liner to prevent leakage. The SFPs use racks to store the spent fuel, with enough capacity to store 1,324 spent fuel assemblies in each SFP; the vertical design prevents spent fuel damage during seismic activity; and provides enough space between the stored spent fuel assemblies to prevent spent fuel reactivity from becoming critical. The water level in the SFPs is maintained at least 23 ft. above the top of the spent fuel stored in the racks to provide sufficient radiation shielding and a water inventory to absorb the decay heat generated by the spent fuel. The level instrumentation is required while any spent fuel is stored in the SFPs to monitor SFP water levels, and the temperature monitoring instrumentation provides essential indication of SFP operating conditions. A leak detection system also is provided to detect leakage of water past the stainless steel liners.

Figure 4-38: Locations of SFPs

Figure 4-39: Unit 1 SFP (inside FHB)



Each SFP has its own independent water cooling system; its equipment operation and maintenance prevent the pool water temperatures from increasing due to spent fuel decay heat. The SFP cooling system normally maintains pool temperatures between 70-75°F and a water inventory in the SFP sufficient to keep spent fuel immersed at all times. The cooling and filtration system maintains boron concentrations to control reactivity; provides a highly reliable pumped-fluid system to transfer decay heat away from the fuel; purifies and demineralizes pool water to maintain SFP water quality; and helps clarify the SFP water with skimmers. Each SFP cooling and filtration system uses one of two redundant pumps to continuously draw water at a maximum rate of 2,300 gpm from the pool and circulate it through a heat exchanger, demineralizer, and filter. Another pump removes contaminants from the surface of the water by continuously recirculating water, drawn from the pool surface by skimmers, through its own filter. In order to abandon the existing plant systems that are normally used to cool the SFP, an independent SFPI will be installed after permanent plant shutdown. Installation activities will begin shortly after each unit shuts down permanently. The Unit 1 installation will be completed near the beginning of 2026, with Unit 2 following near the end of 2026. Details of this modification are provided in Section 4.1.1.2.1.

The necessary operational activities involve the monitoring of system parameters, periodic testing of important equipment functions, and equipment manipulations. The SFP facility equipment requiring maintenance includes instrumentation, pumps, valves, heat exchangers, filters, and ventilation fans, ducting, and dampers.

The proper operation and maintenance of the SFP water chemistry control ensures safe, long-term storage of the spent fuel by providing the capability to sample the SFP water to detect levels of contaminants and monitor for specific parameters. The water chemistry equipment also provides for sampling the SFP water for necessary constituents, maintaining boric acid concentration to control reactivity and pH balance to prevent corrosion of spent fuel assemblies.

The instrumentation must be routinely calibrated and maintained to provide reliable and accurate performance and ensure that all parameters are kept within limits for safe storage of the spent fuel. The instrumentation includes all FHB equipment necessary to monitor and control the SFP water levels, temperatures, chemistry, and pump flow rates and pressures.

The FHB has its own independent ventilation system (FHBVS) whose proper operation and maintenance ensures adequate ventilating air for equipment cooling and personnel comfort. The FHBVS is comprised of two supply fans, three exhaust fans, several dampers to direct and control flows, several rough filters, HEPA filters, and charcoal filters. The FHBVS draws in outside air, which is filtered before being circulated throughout the FHB. Exhaust flow is higher than supply flow to maintain a slight negative pressure, which help prevent unmonitored migration of air and particulate out of the FHB.

The proper maintenance of the FHBVS instrumentation and controls equipment preserves the ability to continuously monitor and control air flow rates, damper positions, air pressures, air temperatures, air radiation levels, and fan vibrations within safe margins. The controls for the FHBVS are designed primarily for automatic operation. When the FHBVS is placed in operation, its control system automatically starts selected fans and positions various mechanical and pneumatic dampers in a prescribed sequence. The FHBVS controls are also designed so that if the fans or dampers fail, the redundant equipment will automatically start.

PG&E reviewed relevant industry operating experience (OE) and benchmarking results associated with transferring spent fuel and GTCC waste from DCPP and other nuclear power plants such as Davis-Besse in Ohio and Comanche Peak in Texas, etc. As a result of these reviews, mitigating strategies (such as procedural upgrades, equipment improvements, work practice improvements, etc.) have already been implemented or are planned for implementation before spent fuel and GTCC waste are transferred to the ISFSI. Examples of relevant OE and the mitigating strategies put in place are:

- OE31410: "Short Loss of Both Spent Fuel Pool Cooling Pumps During Off-Site Electrical Fluctuation" due to non-latching design feature of motor starter. The "non-latching" motor starter design requires manual restart of the SFP Cooling Pump motors after a low voltage condition. DCPP operator response requirements already ensure checks of SFP equipment operation after such events. In addition, SFP pumps are trended in routine operator rounds.
- OE30884: "Foreign Material Concern for Broken Underwater Light Pieces in Spent Fuel Pool" due to inattentive error by MPC loading/rinsing/sampling personnel and insufficient procedure detail for when to grab the concentration sample during MPC initial pump down. DCPP revised procedure RP RPI-2 Task Guidance so that the potential for dilution is more positively controlled through improvements in sampling, standpipe, and vent and drain port rinsing and added this event to future pre-job briefs for this work activity.

The costs directly incurred by SFP operations include specialty tools and equipment (such as SFP underwater inspection equipment and spent fuel bundle lifting tools) and regulatory compliance and inspections staffing (e.g., NRC-required reporting or inspections).

The various system equipment described above requires personnel to monitor system parameters, periodically test important equipment functions and perform inspections, operate, and maintain all equipment, and maintain facility security. These activities all incur indirect costs associated with SFP operations and are reported in Sections 4.1.1.9.3 through 4.1.1.9.5. Other significant contributors to indirect costs reported elsewhere include the addition of the SFPI, procedure changes, licensing and permitting changes, and engineering. These are described elsewhere in Sections 4.1.1.2.1, 4.1.1.9.10, 4.1.1.9.12, 4.1.1.9.13, 4.1.1.9.3, 4.1.2.6.10, 4.1.2.6.12, 4.1.2.6.13, and 4.1.2.6.3.

4.1.2.1.2. Pool Characterization

Pool characterization refers to an evaluation of the inventory of non-fuel material in the SFPs. Items removed from the reactors have elevated dose rates and/or nuclide compositions, which make disposal as low-level waste problematic. These items have accumulated in the SFP over many years of reactor operation. Both Unit 1 and Unit 2 SFPs are used to store non-fuel materials from maintenance and refueling outage activities. These materials are stored in the SFP due to high dose rates to take advantage of the shielding providing by the water volume and the inaccessibility to materials stored underwater. Because there are very limited disposal options the non-fuel items that remain after the reactors are permanently shut down become legacy waste. These legacy wastes may include such items as spent fuel fragments, activated reactor or fuel assembly components removed during maintenance, foreign materials found in the reactor vessel during refueling outages, and cartridge filters used during reactor or fuel maintenance that have high dose rates. Removal of these materials from the SFPs, packaging for transport, and disposal will use special equipment such as shielded containers and will incorporate appropriate radiological controls to ensure personnel safety by minimizing exposure to radiation for decommissioning workers and the public and to protect the environment.

A Legacy Waste Disposition Assessment was conducted to inform various decommissioning work scopes of the legacy wastes anticipated after final plant shutdown; it included the types, quantities, and locations of the legacy waste and whether the legacy waste was radioactive, hazardous, or mixed. For the materials in the SFP, this assessment analyzed plant records, including those regarding non-fuel material stored in the SFPs. The legacy wastes in the SFPs were categorized based on the following criteria:

- GTCC Waste: GTCC waste is a regulatory classification and is defined as radioactive waste that is not generally acceptable for near-surface disposal in which the radionuclide content exceeds 1 times the values of Table 1 in 10 CFR 61.55 or which exceeds the values in Column 3 of Table 2 in 10 CFR 61.55. These materials typically consist of reactor and fuel assembly components exposed to the neutron flux in the active core region during reactor operation.
- Non-GTCC Metals and Special Nuclear Material (SNM): Metal items that are contaminated with radioactive material (RAM) but have not been exposed to the neutron flux in the active region of the reactor or in which the activation profile is not expected to meet the GTCC criteria. Items also may incorporate some quantity of SNM such as U-235 as part of their design and function.
- Filters used during fuel assembly maintenance and reactor refueling cavity work that are contaminated with RAM.

<u>GTCC Waste</u>

GTCC Waste in the SFPs includes the following items:

- Fuel assembly top nozzles
- Portions of the moveable incore drive (MID) thimble guide tubes. (These are reactor components that were exposed to the active core region during reactor operation.)
- Reactor internals split pins for Unit 2
- Debris from up-flow modification of the Reactor Core Barrel for Unit 2
- Baffle former bolts from the Unit 1 Reactor
- Control rod guide tube (CRGT) support pins
- Grid strapping from fuel assemblies
- Fuel assembly inserts, including thimble plugs and burnable poison rod assemblies (BPRAs)

- Unidentifiable metal debris, identified and removed from both reactors during foreign object search and retrieval (FOSAR) conducted during each refueling

These materials are typically stored in debris canisters (or trash baskets). A fuel size canister is 8" by 8" by 160" with a total waste volume of approximately 6 ft^3. There are smaller size canisters measuring 8" x 8" x 10"(waste volume approximately 0.5ft^3) and another provided by a vendor measuring 8" by 8" by 36" (waste volume approximately 1.5ft^3).

The thimble plugs and Burnable Poison rod assemblies (BPRAs) are permitted by the current Part 72 site-specific license to be stored in or with fuel assemblies in dry cask storage at the ISFSI. All used BPRAs have at least one finger that is bent and would require removal before replacing into a fuel assembly. If replacement into fuel assemblies cannot be ensured, these items would be disposed of as GTCC waste and are therefore included in GTCC waste volume. GTCC waste volumes were estimated based on the volume of the debris canister for all GTCC wastes stored in a debris canister. Items not stored in a debris canister (trash basket) used the actual physical dimensions of the item to estimate waste volume.

Table 4-20 and Table 4-21 summarize the GTCC materials in Unit 1 and Unit 2 SFPs, including the type of material, the physical location in the SFP, and the estimated waste volume for the material.

Table 4-20: Unit 1 SFP GTCC

Waste Material	Location	Quantity
Fuel Assembly Top Nozzles	B41, NN17, NN18	(3) fuel size trash baskets - 18ft^3
MIDS Thimbles	AA5, AA7, AA8	(3) fuel size trash baskets - 18ft^3
Baffle Bolt Waste Trash Basket	W40	(1) fuel size trash basket - 6ft^3
Thimble Plugs	FF37, GG37	(2) Thimble Plugs - 1ft^3
Grid strap pieces	FF38	(1) 8" x 8" x 10" trash basket - 0.5ft^3
CRGT Support Pins	N01	(1) 8" x 8" x 36" trash basket - 1.5ft^3
Misc. including FOSAR debris	M01	(1) 8" x 8" x 10" trash basket - 0.5ft^3
Total GTCC Metals in Unit 1 SFP		**45.5ft^3**

Table 4-21: Unit 2 SFP GTCC

Waste Material	Location	Quantity
Fuel Assembly Top Nozzles	A01, A02, A03	(3) fuel size trash cans - 18ft^3
MIDS Thimbles	U36, NN26	(2) fuel size trash cans - 12ft^3
Split pin and up-flow mod debris	EE37	(1) fuel size trash cans - 6ft^3
Thimble Plugs	P10, MM34, MM35, NN34, NN35	(5) Thimble Plugs – 2.5ft^3
BPRAs	LL38, MM36, NN39	(3) BPRAs (8"x8"x160") - 18ft^3
CRGT Support Pins	N01	(1) 8" x 8" x 36" trash can - 1.5ft^3
Misc. including FOSAR debris	M01	(1) 8" x 8" x 10" trash can - 0.5ft^3
Total GTCC Metals in Unit 2 SFP		**58.5ft^3**

Total GTCC waste (as of December 2018) from both Unit 1 and Unit 2 SFPs is 104 ft^3.

Removal of packaging, storage, and disposal of GTCC materials from the SFPs is included in the work scope for GTCC Storage Operations; associated costs are described in Section 4.1.1.5.2.

Non-GTCC Metals and Special Nuclear Material (SNM)

Contaminated metals, non-GTCC irradiated metals and SNM inventory includes the following materials:

- Reactor surveillance capsules, including some that contain SNM. These items are composed of cast iron and although irradiated are not expected to be GTCC
- Hanger plates that fit over the top of a SFP fuel rod cell
- SFP rack specimens
- Filter transfer canister
- Empty trash baskets
- Baffle former bolt contaminated waste

The volume of this waste is expected to be 800 lbs. with a Radioactive Class A Waste (see Section 3.3.2.1 for waste definition) volume of 21 ft^3.

Removal of contaminated metals, non-GTCC irradiated metals, and SNM legacy waste from the SFPs is included in the work scope for System and Area Closure; associated costs are described in Section 4.1.1.6.

Packaging, transportation, and disposal of contaminated metals, non-GTCC irradiated metals, and SNM legacy waste from the SFPs are included in the work scope for Solid Waste Management; associated costs are described in Section 4.1.1.7.2.

If radiological waste characterization of contaminated metals, non-GTCC irradiated metals, and SNM legacy waste from the SFPs is required, this is included in the work scope for Site Personnel Support; associated costs are described in Section 4.1.1.9.6.

Filters

Cartridge filters from fuel inspections, fuels maintenance, and those used in the underwater tri-nuke vacuum during refueling outages typically have higher than average dose rates and are stored in the SFPs to allow for decay. Filters used to support reactor component maintenance (e.g., baffle bolt replacement or upflow modifications) may demonstrate radionuclide profiles higher in isotopes of carbon or nickel that present a challenge to waste classification and may require treatment or special packaging for disposal. Typical refueling outages generate 2 Class A filters from the tri-nuke vacuum, which are stored in the SFPs. These cartridge filters have dimensions of 30 inches in length, 6 inches in diameter, an internal annulus diameter of 4.5 inches, weigh 5.75 lbs., and have a burial volume of 0.491 ft^3.

In Unit 1, after the last SFP filter cleanout campaign in 2012, there were no filters remaining in Unit 1 SFP. Two filters from 1R18 (Unit 1 Refueling Outage Number 18), two filters from 1R19, and two filters from 1R20 have been added to the Unit 1 SFP. Baffle former bolt replacement work performed in 1R20 generated three additional filters with very high dose rates. Two additional filters from a fuel sipping campaign also are stored in the Unit 1 SFP. Assuming two filters from the tri-nuke vacuum are added during each of the five remaining refueling outages for Unit 1, this will add an additional 10 filters to the Unit 1 SFP for a total of 21 filters to be removed from Unit 1 SFP.

In Unit 2, after the last SFP filter cleanout campaign in 2012, 10 filters with dose rates considered too high to be removed during the filter removal campaign remain in the Unit 2 SFP. Two filters from 2R17, two filters from 2R18, and two filters from 2R19 have been added to the Unit 2 SFP pool. Two additional filters from a fuel sipping campaign also are stored in the Unit 2 SFP. Two more tri-nuke filters are anticipated from each of the six remaining refueling outages for Unit 2; this will add an additional 12 filters to the Unit 2 SFP for a total of 30 filters to be removed from Unit 2 SFP.

In total, 51 filters with a mass of approximately 300 lbs. and a waste volume of slightly more than 25 ft^3 is estimated from both SFPs.

Removal of cartridge filters from the SFPs is included in the work scope for System and Area Closure; associated costs are described in Section 4.1.1.6.

Packaging, transportation, and disposal of cartridge filters from the SFPs are included in the work scope for Solid Waste Management; associated costs are described in Section 4.1.1.7.2.

If radiological waste characterization of cartridge filters from the SFPs is required, this is included in the work scope for Site Personnel Support; associated costs are described in Section 4.1.1.9.6.

4.1.2.2. ISFSI Management

4.1.2.2.1. ISFSI Operations

ISFSI operations consists of the security, operation, and maintenance of all on-site ISFSI equipment that is required to ensure adequate protection of the public health and safety and the environment while protecting and storing SNF in dry storage casks located at the ISFSI. Refer to Section 4.1.1.5.2 for details of similar ISFSI security, operation, and maintenance activities associated with the storage of GTCC waste.

ISFSI operations also consists of the activities required to safely and securely transfer spent nuclear fuel and GTCC waste off-site to a DOE-approved location, yet to be determined. The location will ultimately be determined by the DOE in accordance with 10 CFR 961, “Standard Contract for Disposal of Spent Nuclear Fuel and /or High-Level Radioactive Waste.” PG&E is obligated by the standard contract with the DOE to place the storage canisters containing spent fuel and GTCC into DOE-supplied transportation casks and have them ready for the DOE to pick up. The DOE will take possession of the SNF and GTCC waste on PG&E property.

A total of eight casks of GTCC segmentation waste, two casks of GTCC Legacy waste, and 138 casks of SNF will require transfer to an off-site waste repository. The ISFSI operations security consists of maintaining those measures, required by the NRC that are necessary to control personnel, vehicles, and materials entering or leaving the ISFSI during dry cask storage as well as during the transfer off-site of spent fuel and GTCC waste. All ISFSI equipment, including the storage casks, must be operated and maintained properly to provide the continuous capability to safely store spent fuel and GTCC waste, to remove decay heat generated by spent fuel, and to provide shielding from the radiation given off by spent fuel and GTCC waste. All ISFSI transfer equipment must be maintained properly for an extended period to provide the capability to safely transfer the spent fuel and GTCC waste to the DOE.

10 CFR Part 72 contains license requirements and criteria for the issuance of licenses to receive, transfer, and possess nuclear power reactor spent fuel, power reactor-related low level radioactive waste, and other radioactive materials associated with spent fuel storage in an ISFSI; it also notes the terms and conditions under which the NRC will issue these licenses. These regulations also establish requirements, procedures, and criteria for the issuance of licenses to the DOE to receive, transfer, package, and possess power reactor spent fuel, power reactor-related low-level waste, and other radioactive materials associated with the storage of these materials in a monitored retrievable storage installation, as defined in 10 CFR 72.3. The regulations in this part also establish requirements, procedures, and criteria for the issuance of Certificates of Compliance approving spent fuel storage cask designs.

Because there are no off-site disposal facilities licensed to receive spent fuel and GTCC waste, all spent fuel and GTCC waste must be packaged and stored at the site where it was generated. All spent fuel removed from the Unit 1 and Unit 2 reactors during the plant’s operating life will remain in the SFPs until the decay heat is reduced to the acceptable limits for safe transfer to the ISFSI for dry cask storage (see Section 4.1.2.3.1).

The ISFSI uses a dry cask storage system made by Holtec International to store spent fuel and GTCC waste. The design of the ISFSI will accommodate a total of 148 dry casks for storing spent fuel (138) and GTCC waste (10). The Holtec system satisfies NRC-required safety and security functional requirements by providing radiation shielding, ventilation passages for required air cooling on spent fuel casks, missile protection, protection against natural phenomena and accidents, and cask anchor bolting that protects against seismic activity.

All GTCC waste and spent fuel will be stored at the ISFSI within seven years of permanent shutdown of Unit 2. The DOE is assumed to begin accepting all GTCC waste and spent fuel from DCPP at an off-site facility starting in 2038 and is projected to complete all transfers for DCPP by 2067. Therefore, ISFSI operations activities must maintain the capability to safely and securely store GTCC waste and spent fuel for approximately 43 years after permanent plant shutdown. During this significant length of time while storage occurs, the ISFSI security systems must be maintained and the condition of the dry casks monitored to ensure the protection of the public health and safety and the environment. The operation and maintenance of the ISFSI security systems as well as the monitoring of the dry casks must be performed in accordance with NRC requirements. The monitoring of the dry casks requires continuous security resources to ensure they are protected and daily operations' monitoring resources to ensure that their functional requirements remain intact. Other activities, required to ensure the protection of the public health and safety and the environment during the ISFSI storage period, include:

- Performing ISFSI maintenance as needed (such as utility upkeep, security systems routine maintenance and testing, concrete pad maintenance, monthly cask inspections, etc.)
- Performing various required annual and semi-annual NRC reporting/facility inspections in accordance with NRC Inspection procedures 36801, 37801, 60855, 60857, 60858, 62801, 71801, and 84750
- Performing CISCC inspections every five years of the spent fuel and GTCC storage canisters, in accordance with NUREG-2214
- Making any specialized equipment available, such as special tooling or inspection equipment

The future implementation of the off-site transfers will be performed in accordance with the requirements of the 10 CFR 961 Standard Contract and those transfer activities that PG&E is responsible for, as well as those that the DOE are responsible for, as specified in Article IV of the 10 CFR 961 Standard Contract. During the future implementation of the off-site transfers of the spent fuel and GTCC waste dry storage canisters to the DOE, each long-term storage dry cask will be unbolted from its ISFSI pad location (refer to Figure 4-41) and moved with a vertical cask transporter (VCT) (refer to Figure 4-42) to the CTF. The inner storage canister (containing either spent fuel or GTCC waste) (refer to Figure 4-40) will then be transferred from the long-term storage dry cask into a shipping cask and sealed for off-site transport. This shipping cask will then be loaded onto an approved carrier (heavy haul transport truck and trailer) and transported to an approved off-site storage site. Options for transfer of GTCC waste from DCPP for off-site disposal at a 10 CFR Part 61 licensed facility are under consideration; the disposal location will be determined at a later date, depending on final approvals from the DOE and the NRC.

Figure 4-40: Storage Multiple Purpose Canister (MPC)

Figure 4-41: Storage Over-pack Dry Casks Containing Spent Fuel Stored at ISFSI (HI-STORM)

Figure 4-42: Vertical Cask Transporter

During the future implementation of the off-site transfers of the spent fuel and GTCC waste, the protection of the public health and safety and the environment must be maintained. The equipment that will be used to implement the off-site transfers of spent fuel and GTCC waste was evaluated to determine the most cost-effective and feasible strategy for ensuring that the future transfers can be completed.

Options evaluated for transfer equipment included:

- Option 1.1: Ensure that two VCTs are available and maintained for redundancy and to gain efficiencies during transfer operations. This includes maintaining the transfer equipment on a routine basis for the 30 years that storage will occur at the ISFSI and primarily consists of maintenance of two VCTs. A new storage building for the VCTs will be constructed near the ISFSI (see Section 4.1.2.3.1).
- Option 1.2: Use a single VCT and only maintain the existing VCT on a routine basis from when the plant is permanently shutdown until all spent fuel and GTCC waste is transported off-site.

The reliance on a critical piece of equipment (existing VCT) that is aging after prolonged storage (Option 1.2) is a significant project risk. If the use of a single VCT were implemented and a VCT failure were to occur during the off-site loading process, the DOE-allotted window to ship casks off-site could be missed. This could mean that the ISFSI must remain operational for years beyond the planned end date for off-site fuel shipment in 2067, increasing overall costs. Maintaining the availability of a second VCT provides a significant measure of defense-in-depth by ensuring that at least one functional VCT will always be available. In addition, the concurrent use of a second VCT during transfer activities will reduce the time it takes for the overall transfer. For these reasons, Option 1.1 will be implemented via purchase of new VCTs (the option to lease was evaluated as unacceptable because lease units may be unavailable). The existing VCT will be retired in 2048 at the end of its 20-year recertification period, and a replacement VCT will be procured. This, along with the second VCT to be purchased prior to 2030 (see Section 4.1.2.3.1), will continue to maintain the desired defense-in-depth.

Options also were evaluated for loading/offloading transportation casks. This was done to determine the most cost-effective and feasible strategy for providing the capability, on an annual basis for 30 years, to (1) offload the empty shipping casks from a heavy haul trailer once they are received at DCPP, and (2) load the full shipping casks onto a heavy haul trailer once they are loaded with spent fuel or GTCC waste at DCPP. Options evaluated included:

- Option 2.1: Use of an overhead gantry system (single-failure design), purchased and permanently installed near the ISFSI
- Option 2.2: Use of an overhead gantry system (single-failure design), leased and mobilized/demobilized each year near the ISFSI
- Option 2.3: Use of a permanently installed heavy haul loading dock, constructed below grade, east of the ISFSI near the location where the VCT Building will be located (see Section 4.1.2.3.1). Refer to Figure 4-43.

Figure 4-43: Location of New Heavy Haul Loading Dock

Option 2.3 was chosen as the most cost-effective option for loading and offloading transportation casks. The basis for selecting Option 2.3 is as follows:

- Option 2.3 avoids the initial purchase price and ongoing routine maintenance and certification costs over 30 years associated with Option 2.1.
- Option 2.3 avoids the annual lease and mobilize/demobilize costs over 30 years associated with Option 2.2.

- Option 2.3 avoids the use of a complex piece of equipment with a potential to malfunction and uses a structure passive in design. The structure will be a ramp built so that a heavy haul truck and trailer will drive down into it below grade such that the top of the trailer surface will be at grade level. This will allow the VCT to straddle the trailer and remove empty casks being delivered as well as reload full casks that are being transferred off-site.

In addition to the security, operations, and maintenance for the dry casks during storage and off-site transfer, ISFSI operations consists of the activities required to prepare and plan for safe transfer of the canisters containing spent fuel and GTCC waste to an off-site facility.

The preparation and planning phase for spent fuel and GTCC transfer is expected to take up to three years to the first dry runs for fuel transfer and transport to off-site facilities. Per the 10 CFR 961 standard contract, PG&E is responsible to provide the DOE with the following:

- Information on spent fuel/GTCC waste inventory, including quantity and characteristics
- All preparation, packaging, required inspections, and loading activities for the transportation of spent fuel/GTCC waste to the DOE facility
- Notification of spent fuel transfer activities 60 days before activities begin
- Written notification of the material descriptions in each shipping lot
- Incidental maintenance of shipping casks furnished by DOE

During the preparation and planning phase, PG&E will establish the following:

- Implementation of infrastructure improvements [heavy haul dock design, permitting, license revisions, and construction]
- Plans to mobilize and certify the VCTs as well as plans to demobilize the VCTs
- Hardware and components necessary for the transfer (e.g., rigging, measuring and test equipment such as torque wrenches; transport components such as casks and rail cars; and consumables such as lubricants)
- Support services required for the transfer (e.g., radiation protection monitoring and support, quality control oversight; and industrial safety technicians)
- Stakeholder interfaces with local, state, and federal regulatory and oversight authorities, including the CCC, EPA, NRC, and DOE
- Permitting for material transfer
- Updated procedures and processes necessary for the transfer of spent fuel and GTCC waste
- Crew size, crew training and qualification requirements, schedule, and duration to support the transfer of the canisters containing the spent nuclear fuel and GTCC from the ISFSI to the shipping conveyance

The planning process costs will be composed primarily of transport cask procurement and staffing costs. Once the plans are approved, the tools, equipment, components, and systems necessary for the spent fuel and GTCC waste transfer to off-site facilities will be procured. Finally, before beginning the transfer process, crews will be secured to perform the transfers and the support services needed for the transfers.

The execution phase for transfer off-site of the 148 canisters of spent fuel and GTCC waste is planned to take approximately 30 years, from 2038 to 2067 (in accordance with the 10 CFR 961 standard contract, the current annual allotment was evaluated and it was concluded that PG&E will be able to load a maximum of five full MPC canisters into five DOE-supplied transportation casks each year). The major steps in the transfer execution process are as follows:

1) Receive DOE-supplied empty transportation casks for canister loading at the heavy haul loading dock
2) Transfer canisters from HI-STORM or HI-SAFE dry casks to transportation casks at the ISFSI
3) Load full transportation casks onto the DOE supplied heavy haul track trailer
4) Support safe and secure exit from the ISFSI site

The costs directly incurred by ISFSI operations during the spent fuel and GTCC waste storage activities include:

- Upgrades to facility equipment (such as replacement of the original VCT)
- Upgrades to infrastructure (such as design and constructions costs for a new heavy haul dock)
- Specialized work requiring contracts (such as aging management and storage equipment inspections)
- Specialized tooling and equipment (such as those required for specialized inspections of storage equipment)
- Regulatory compliance and inspections staffing (e.g., NRC-required reporting or inspections during storage)
- Permitting compliance (obtaining state or county ministerial permits)

The costs directly incurred by ISFSI Operations during the spent fuel and GTCC waste pre-transfer and transfer activities include:

- Preparation of those licensing and permitting revisions required to transfer the spent fuel and GTCC waste from the ISFSI to an off-site facility
- Specialized work requiring contracts (such as annual off-site transfer execution campaigns, mobilization/demobilization costs associated with the annual off-site transfers, VCT inspections or certifications, etc.)
- Specialized tooling and equipment (such as inspection equipment and transfer tools)
- Regulatory compliance and inspections staffing (e.g., NRC-required pre-transfer and transfer reporting or inspections)
- Off-site storage/disposal facility coordination prior to and during transfer activities
- Off-site transport coordination prior to and during transfer activities
- Costs related to engineering resources required for pre-transfer preparations

The facility equipment requires personnel to monitor equipment conditions, periodically test important equipment functions and perform inspections, operate and maintain all equipment, and maintain facility security. These activities all incur indirect costs associated with ISFSI operations; those costs are reported in Sections 4.1.1.9.4, 4.1.1.9.5, and 4.1.1.9.8. The additional security required during periods of spent fuel and GTCC transfer to the DOE is another primary contributor to the indirect staffing costs for ISFSI operations; those costs are reported in Section 4.1.1.9.8. Other significant contributors to indirect costs reported elsewhere include those associated with facility and operations procedure changes. These costs are reported elsewhere in Section 4.1.1.9.10.

4.1.2.2.2. ISFSI Preliminary Radiological Decommissioning Plan

ISFSI for storing spent nuclear fuel and associated radioactive materials are licensed by the NRC. ISFSIs are licensed in accordance with the Atomic Energy Act of 1954 (42 United States Code [USC] 2011, et. seq.) and NRC implementing regulations. 10 CFR Part 72 contains regulations that establish requirements and criteria for the issuance of licenses to receive, transfer, and possess nuclear power reactor spent fuel, power reactor-related low level radioactive waste, and other radioactive materials associated with spent fuel storage in an ISFSI, and the terms and conditions under which the NRC will issue these licenses. The DC ISFSI radiological decommissioning is contingent on the DOE taking possession and removing the spent fuel and GTCC waste from the site. It is assumed that DOE will begin accepting spent fuel at an off-site facility from DCPP in 2038 to complete transfer by 2067.

Within 60 days of deciding to permanently cease principal activities at the entire ISFSI site, consistent with 10 CFR 72.4(d), PG&E shall notify the NRC in writing, and submit within 12 months of such notification, a final decommissioning plan and begin decommissioning upon approval of the plan and acquisition of all applicable federal, state, and local permits.

Pursuant to 10 CFR 72.54(g), the PRDP must include the following information:

- A description of the current conditions of the site or separate building or outdoor area sufficient to evaluate the acceptability of the plan
- The choice of the alternative for decommissioning with a description of the activities involved.
- A description of controls and limits on procedures and equipment to protect occupational and public health and safety
- A description of the planned final radiation survey
- An updated detailed cost estimate for the chosen alternative for decommissioning, comparison of that estimate with present funds set aside for decommissioning, and plan for ensuring that adequate funds are available for completion of decommissioning, including means for adjusting cost estimates and associated funding levels over any storage or surveillance period
- A description of technical specifications and quality assurance provisions in place during decommissioning

If the final decommissioning plan demonstrates that the decommissioning will be completed as soon as practicable, performed in accordance with 10 CFR 72.54(i), and will not be inimical to the common defense and security or to the health and safety of the public, and after notice to interested persons, the NRC will approve the PRDP subject to any appropriate conditions and limitations and issue an order authorizing decommissioning. Decommissioning also will require acquisition of all applicable federal, state, and local permits. Pursuant to 10 CFR 72.54(j)(1) and (2), PG&E must complete decommissioning of the ISFSI and request termination of the site-specific license as soon as practical, but no later than 24 months after the NRC approves the PRDP. The NRC may approve a request for an alternate schedule for completing the ISFSI decommissioning and license termination if the NRC determines that the alternate schedule is warranted.

As a final step, PG&E will certify the disposition of all licensed material, including accumulated wastes, by submitting a completed NRC Form 314 or equivalent information; conduct FSS of the premises where the licensed activities were conducted and submit a report of the FSS results. The Part 72 license will be terminated by written notice to the licensee when the NRC determines that the decommissioning has been performed in accordance with the approved final decommissioning plan and the order authorizing decommissioning; the FSS has been performed that demonstrates the premises are suitable for release in accordance with the criteria for decommissioning in 10 CFR Part 20, Subpart E; and records required by 10 CFR 72.80(e) have been received.

The planning costs will be composed of plan development and overhead staffing costs. The costs incurred directly by the PRDP include:

- Development of the PRDP will review, confirm, and incorporate an FSS Plan, which will be prepared and costed separately (see Section 4.1.2.2.4)
- Staffing
  - ☐ Submittal of the PRDP to the NRC
  - ☐ Coordination with the NRC staff
  - ☐ Submittal of FSS results
  - ☐ Attending hearings

4.1.2.2.3. ISFSI Decommissioning

ISFSI Decommissioning involves the removal of site features (such as concrete pads, security fences, and the Security Building) that are required to remain in place until the end of ISFSI operation. This will occur before final site restoration of the ISFSI area. The ISFSI is located northeast of the Unit 1 Containment at an elevation of approximately 310', situated directly on bedrock at the site area. The physical elements consist of the ISFSI itself, which is a level pad that was created by cutting into the toe of an existing slope with rock anchors and shotcrete stabilization of the cut; the pad between the ISFSI and Diablo Creek, which includes the area that contained the two freshwater reservoirs; a road, and storage area parallel to and north of the road at the top of the southern slope of Diablo Creek; open pad areas to the east of the ISFSI on either side of the 500-kV Switchyard; and the firing range complex at the base of ISFSI Road.

The 52,500-square ft. ISFSI storage pad system consists of seven individual storage pads. Each pad is constructed of heavily reinforced 5,000 psi concrete and is approximately 7.5 ft. thick with horizontal reinforcing bars (both longitudinal and transverse) at the top and bottom of the pads. This does not include the planned expansion to accommodate the GTCC waste (see Section 4.1.1.5.1).

After all spent fuel and GTCC material have been removed and transferred to DOE, demolition of the ISFSI will begin. The first step will be decontamination of material associated with the ISFSI pad. Assuming that the storage canisters of spent fuel cannot be externally contaminated with radioactive material by the loading process, there is a low probability of radiological contamination of the ISFSI pad. There is likely to be localized low level activation of the concrete pad near the surface due to long-term exposure to levels of neutron radiation that may activate some of the concrete surrounding the spent fuel. However, these levels are not expected to require pre-treatment or specific remediation efforts to meet OAD criteria before the pad is demolished. This will be evaluated by taking samples of concrete materials from pre-determined locations through core sampling. If necessary, consistent with procedures outlined in Section 4.1.1.3.3, the pad will be pre-treated to meet open air demolition criteria and the surface decontaminated to meet site-specific DCGLs.

ISFSI demolition is the dismantlement and removal of the ISFSI and other remaining structures, such as the Security Building and firing range (this likely will require lead abatement), which includes the engineering and pre-planning required to safety remove the structure. ISFSI demolition will take place before the grading and landscaping activities outlined in Section 4.1.2.2.4. It includes the removal of man-made elements (all aboveground structures and utilities, asphaltic concrete pavement, concrete slabs, and concrete foundations to 3 ft. below grade surface, subsurface utilities, and any concrete lining of utility trenches, retaining walls, etc.). It ends when the ISFSI and other structures are demolished, and the demolished material is transferred per waste management direction.

The ISFSI pad will be demolished using a combination of standard demolition equipment and methods. It will be broken into manageable size pieces and removed. The steel embedment rings and reinforcing wire will be separated from the concrete as necessary for reuse or recycling of the concrete, if possible. The storage pad and other remaining structures will be demolished using a combination of standard demolition equipment and methods, including excavators with hydraulic breakers/pulverizers, shear, thumb, and bucket attachments; front-end loaders; skidsteers; torches; and concrete saws. No explosive materials or wrecking balls will be used. Demolition of any buildings and objects in remote areas, such as the ranch buildings, will likely be removed with small tracked equipment and skidsteers, and transported to the main site for handling and processing by articulated dump trucks. This methodology will minimize disturbance to the remote areas.

Excluding the ISFSI pad and its apron, approximately eight acres of other paved parking areas, sidewalks, concrete aprons, pads, and ground cover will be removed. Approximately three acres of the removal will be asphalt and five acres will be concrete primarily associated with the ISFSI area. These removals include the ISFSI support area; parking around Warehouse 113 area and around the gun range; concrete sidewalks, aprons, and pads and similar coverings around buildings to be demolished; and the shotcrete hillside facings behind the ISFSI. Other remaining features to be removed including retaining walls, fences, concrete block barriers, and steel guardrails. Man-made voids remaining after completion of the demolition activities will be backfilled with engineered fill. These include building slab and foundation areas, vaults, and trenches remaining after subsurface utilities removals (system piping), electrical pull boxes, stormwater conveyance channels, and other miscellaneous voids.

The planning process costs will be comprised primarily of development of decommissioning plans and overhead staffing costs. Once the decommissioning plans are approved, the tools, equipment, and materials necessary to carry out the work will be procured. ISFSI decommissioning will be carried out per plan specifications. Any required discretionary or environmental permits are noted in Section 4.1.2.6.12.

The costs directly incurred by ISFSI decommissioning include:

- Development of specifications, design, drawings, calculations, and work plans required to support the generation of decontamination and removal plans with an engineering survey
- Obtaining ministerial permits
- Mobilization, installation, maintenance, and removal of any required BMPs and SWPPP measures
- Obtaining tooling and equipment (e.g., dozer, backhoe, and excavator)
- Conducting civil work, including demolition and removal of ISFSI facilities, foundation, underground utilities and remaining structures, and filling of voids
- Mobilization and demobilization cost

Costs for handling demolished material and for transporting it off-site are noted in Section 4.1.2.4.

The total direct ISFSI decommissioning cost estimate is shown in Table 4-1.

4.1.2.2.4. ISFSI Restoration

ISFSI restoration is the program to restore the ISFSI site to natural conditions, whereby structures have been demolished and removed, soil has been remediated, areas have been graded and filled to create natural contours, and landscaping and planning conducted to allow native vegetation to grow. There are three main work activities: (1) soil remediation; (2) FSS; and (3) grading and landscaping. Areas subject to ISFSI restoration include the ISFSI; the pad between the ISFSI and Diablo Creek, which includes the area that contained the two freshwater reservoirs; open pad areas to the east of the ISFSI on either side of the 500 kV Switchyard; the firing range complex at the base of ISFSI Road; and former parking areas and other paved areas that were removed.

Soil remediation is the process to excavate and remove chemically and radiologically contaminated soil to the point where remediated soils meet chemical and radiological cleanup criteria. It starts when contaminated soil is moved, which may take place before, during or after ISFSI demolition activities and is completed when cleanup criteria have been met and the area is ready for FSS. It will be carried out consistent with the procedures outlined in Section 4.1.3.1.1 and restricted to areas subject to ISFSI restoration as outlined above. Particular areas that may be subject to soil remediation include the ISFSI pad area and the firing range area.

FSS are the procedures for systematically surveying for radiological contamination and generating records for submittal to the NRC to enable the ISFSI site to be released from the Part 72 site-specific license. This rigorous survey process requires specialized skill sets and substantial and accurate documentation under a quality-related program. The planning phase of the FSS scope starts in concert with the remediation phase. They are designed to demonstrate that licensed radioactive materials have been removed from the ISFSI site to the extent that the remaining radiological contamination is below the radiological criteria for unrestricted release. FSS will be carried out consistent with the procedures outlined in Section 4.1.3.1.2. In particular, once the pad is demolished, the former pad area will be surveyed to meet the requirements of MARSSIM Class I due to the long-term presence of licensed materials stored in the area. FSS under ISFSI restoration will be limited to an area within an updated Part 72 license OCA boundary that is conservatively estimated to be 300 meters from the outer edge of the ISFSI pad.

Grading and landscaping is one of the final steps in restoring the ISFSI site. It includes development of site grading and drainage plans; placement of ground cover, including vegetation and other surfacing; road construction and repairs; installation of fencing and site lighting; development of long-term stormwater management; and other final site development work to achieve the required end-state condition for the future use of the site. The level of grading and landscaping that was required by federal, state, and local agencies for decommissioning HBPP was used as the basis for the assumed level required for the ISFSI area and other areas. Grading and landscaping will be carried out consistent with the procedures outlined in Section 4.1.3.1.3; however, it will only include the areas subject to ISFSI restoration as outlined above.

The planning process costs will be comprised primarily of development of restoration plans and overhead staffing costs. Once the plans are approved, the tools and equipment to carry out ISFSI restoration will be procured. Any required discretionary or environmental permits are noted in Section 4.1.3.5.12.

The costs directly incurred by ISFSI restoration include:

- Development of remediation, FSS, grading and landscaping, and compliance and monitoring plans
- Obtaining ministerial permits
- Mobilization, installation, maintenance, and removal of any required best management practices (BMPs), and SWPP measures
- Obtaining tooling, equipment (e.g., shovels, backhoe, and excavator), and laboratory facility
- Conducting pre-construction surveys
- Conducting civil work, including grading, rerouting or repair of drainage systems, and establishing stormwater detention basins
- Civil work to excavate and remove contaminated soil
- Surveys to confirm that cleanup criteria have been met and areas are ready for FSS
- Perform FSS and evaluate samples in laboratory

- Conducting landscaping and planting
- Conducting monitoring during construction and restoration activities
- Preparing and submitting monitoring reports and obtaining approvals from regulatory agencies
- Obtaining equipment and supplies to conduct maintenance/additional planting and landscaping
- Conducting maintenance/additional planting and landscaping
- Mobilization and demobilization costs

The total direct ISFSI restoration cost estimate is shown in Table 4-1.

4.1.2.3. Spent Fuel Transfer Operations

4.1.2.3.1. Spent Fuel Transfer Operations

Spent fuel transfer operations consists of transferring spent fuel and GTCC waste from the SFPs to the on-site ISFSI. Spent fuel transfer operations primarily consists of two phases: (1) the equipment operation and maintenance during packaging and loading of spent fuel and GTCC waste and (2) the equipment operation, maintenance, and security during transfers of spent fuel and GTCC waste from the SFPs to the ISFSI. All spent fuel and GTCC waste stored in the Unit 1 and Unit 2 SFPs, as well as GTCC waste generated during reactor dismantling, is planned to be packaged and transferred to the on-site ISFSI within seven years of Unit 2's permanent shutdown. The transfer operations are planned to begin in August 2030 and conclude in June 2032 and, in order to minimize mobilization and demobilization costs, will be conducted as a single, continuous campaign for all Unit 1 and Unit 2 spent fuel and GTCC waste. The future transfers of spent fuel and GTCC waste from the ISFSI to an off-site facility are addressed in Section 4.1.2.2.1.

During the first phase, in order to provide the continuous capability to safely package and load spent fuel and GTCC waste, all loading equipment must be operated and maintained properly. Similarly, during the second phase, in order to provide the continuous capability to safely and securely transfer spent fuel and GTCC waste to the ISFSI, all transfer equipment must be operated and maintained properly, and security forces deployed. The spent fuel transfer operations security consists of maintaining those measures required by the NRC that are necessary to control personnel, vehicles, and materials during the transfers of spent fuel and GTCC waste from the SFPs to the ISFSI in order to ensure adequate protection of the public health and safety and the environment.

Because there are currently no off-site disposal facilities licensed by the DOE to receive spent fuel and GTCC waste, it must be packaged and stored at the site where it was generated. All spent fuel removed from the Unit 1 and Unit 2 reactors must remain in the SFPs until the decay heat is reduced to acceptable limits for safe transfer to the ISFSI for dry cask storage. All GTCC waste (in the form of metallic materials) removed from the Unit 1 and Unit 2 reactors during power operations, referred to as GTCC legacy waste, will remain in the SFPs until it is transferred to the ISFSI after permanent plant shutdown. All GTCC waste generated after permanent plant shutdown during dismantling of the Unit 1 and Unit 2 reactors, referred to as GTCC segmentation waste, will not be stored in the SFPs and will be transferred directly from the point of generation (Containment Buildings) to the ISFSI after final cask packaging and processing takes place at the Cask Washdown Area on the north end of the Unit 2 SFP.

The transfer operations are required to be conducted in accordance with Part 72 license regulations that establish requirements, procedures, and criteria for the issuance of licenses to receive, transfer, and possess nuclear power reactor spent fuel, power reactor-related low level radioactive waste, and other radioactive materials associated with spent fuel storage in an ISFSI, and the terms and conditions under which the NRC will issue these licenses.

The SFPs are in the FHB, a steel-framed building anchored to the concrete Auxiliary Building structure. The FHB encloses the two fuel handling areas of Unit 1 and Unit 2 and is a shared structure that contains the Unit 1 and Unit 2 SFPs, the fuel handling cranes, fuel racks, and related equipment located on each side of the east end of, and adjacent to, the Auxiliary Building.

The dry cask storage system used at the ISFSI must be maintained and operated in a manner that ensures the continuous capability to safely and securely transfer spent fuel and GTCC waste from the SFPs to the ISFSI. The ISFSI uses a dry cask storage system made by Holtec International to store spent fuel and GTCC waste, called the HI-STORM 100 System. This system is comprised of:

- A storage multiple purpose canister for spent fuel, referred to as an MPC, capable of storing up to 32 spent fuel bundles (refer to Figure 4-40)
- A storage overpack dry cask for spent fuel, referred to as a HI-STORM (refer to Figure 4-41)
- A storage NFWC for metallic GTCC waste (similar to a MPC)
- A storage non-fuel waste overpack dry cask for GTCC waste, referred to as a HI-SAFE (similar to a HI-STORM)
- A transfer cask, referred to as a HI-TRAC
- A low-profile transporter (LPT)
- A VCT (refer to Figure 4-42)

The design of the ISFSI will accommodate a total of 148 dry casks for storing spent fuel and GTCC waste. The designs of the storage canisters (spent fuel MPC and GTCC waste NFWC) and the operational process for handling the MPCs and NFWCs during storage and transfer operations ensure that the radioactive materials are contained within the sealed MPCs and NFWCs. This minimizes the potential for contamination of the ISFSI components and structures. The HI-STORM dry cask is a rugged, heavy-walled cylindrical container. The main structural function of the storage overpack is provided by carbon steel, and the main shielding function is provided by unreinforced concrete (installed in the cask after delivery to the site, before loading an MPC). The overpack concrete is enclosed by cylindrical steel shells, a thick steel baseplate, and a top plate. The overpack lid is designed as a steel-encased concrete disc to provide neutron and gamma attenuation in the vertical direction. Inlets at the bottom and corresponding outlets at the top of the overpack allow air to circulate naturally to cool the MPC for spent fuel storage. The inner shell of the overpack has guides attached to its inner diameter to guide the MPC during insertion/removal and to allow cooling airflow to circulate through the overpack. The HI-SAFE dry cask is of similar design and uses concrete as a shielding medium, however it does not include air cooling passages because this feature is not required for GTCC storage. The designs of the MPC and NFWC provide radiation shielding, missile protection, protection against natural phenomena and accidents; the ISFSI pad dry cask anchor bolting provides protection against seismic activity for both spent fuel and GTCC waste.

After permanent shutdown, a total of 1,261 spent fuel assemblies from Unit 1 and 1,281 spent fuel assemblies from Unit 2 will have to be transferred from the SFPs to the ISFSI, which will require the transfer of 80 total MPCs. After permanent shutdown, the total amount of GTCC legacy waste will require the transfer of one NFWC for each unit from the SFPs to the ISFSI. After permanent shutdown the total amount of GTCC segmentation waste will require the transfer of an additional four NFWCs for each unit from the Containment Buildings to the ISFSI. The combination of the spent fuel and GTCC legacy and segmentation waste for both Unit 1 and Unit 2 will require the transfer of 80 individual MPCs and 10 individual NFWCs, with each MPC and NFWC transfer performed as a separate evolution.

The transfer preparation evolutions described below will be conducted underwater in accordance with rigorously controlled processes and conditions to reduce radiation exposure to the lowest possible levels and ensure that the highest level of safety is maintained.

- In preparation for the transfer of spent fuel from the SFPs to the ISFSI, a single empty MPC will be installed in a HI-TRAC transfer cask and placed underwater at the bottom of the SFP. Thirty-two spent fuel bundles will be retrieved from the SFP vertical storage racks in the SFPs and packaged in the MPC while still underwater. The MPC will be temporarily sealed with a lid and, while still cradled in the HI-TRAC, will be removed from the SFP, rinsed down, and staged at the Cask Washdown Area on the north end of the Unit 2 SFP for final transfer preparation processing, which includes MPC draining and flushing with helium (both Unit 1 and Unit 2 final transfer preparation processing will take place at the Cask Washdown Area on the north end of the Unit 2 SFP).
- The preparation for safe transfer of GTCC legacy waste (metallic material) from the SFPs to the ISFSI will be accomplished underwater in similar fashion to the spent fuel transfer preparations. The GTCC legacy waste will be retrieved from various storage location baskets in the SFP and loaded into an NFWC (one per unit). For both Unit 1 and Unit 2, the NFWC/HI TRAC will then be staged at the Cask Washdown Area on the north end of the Unit 2 SFP for further transfer preparation processing.
- The preparation of the GTCC segmentation waste for transfer will occur in a similar fashion. However, a significant difference is that this waste will be packaged in each of four NFWCs for each unit while underwater in the reactor cavity in the Containment Building. Once removed from the reactor cavity, each loaded NFWC cradled in the HI-TRAC will be staged at the same Cask Washdown Area on the north end of the Unit 2 SFP.

The final packaging process will be the same for spent fuel, GTCC legacy waste, and GTCC segmentation waste and will be conducted in accordance with rigorously controlled processes and conditions to reduce radiation exposure to the lowest possible levels and ensure that the highest level of safety is maintained. A lid will be permanently seal-welded on the top of the MPC or NFWC, and the interior of the MPC or NFWC will be drained. All residual moisture will then be removed with a specialized dehydration unit and the canister charged with helium (assists in dissipating heat during long-term storage). The HI-TRAC, with the MPC or NFWC still inside, will then be temporarily sealed for an additional measure of safety. At this point, the loaded MPC or NFWC inside the HI-TRAC will be ready for transfer to the ISFSI.

Because the FHB and the ISFSI are both PAs, and the path between the FHB and the ISFSI is not a PA, the transfer between the FHB and the ISFSI of the HI-TRAC casks containing loaded MPCs and NFWCs is required by the NRC to be conducted with specific dedicated security resources. The transfer evolution for spent fuel described below will be conducted in accordance with rigorously controlled processes to maintain the highest level of radiological and industrial safety:

- The temporarily sealed HI-TRAC, with the loaded MPC still inside, will be placed on the LPT and moved out of the FHB.
- The HI-TRAC containing the MPC will be lifted off the LPT by the VCT and slowly transported from the FHB to the ISFSI area. A HI-STORM cask will be lowered into the CTF, a transfer pit, 20 ft. deep, located on the north side of the ISFSI pad. This CTF pit is intended to provide protection against seismic activity during transfer activities (refer to Figure 4-44). A mating device and the HI-TRAC containing the MPC will then be placed on top of the HI-STORM cask already in the CTF.
- Once placed on top of the HI-STORM cask, the HI-TRAC temporary sealing will be removed and the MPC will be lowered from inside the HI-TRAC down into the HI-STORM. A lid will then be installed on the HI-STORM dry cask. The HI-STORM dry cask containing the loaded MPC will be lifted out of the CTF pit by the VCT and moved to its on-site storage location in the ISFSI, where it will be secured to the concrete pad with anchor bolts for long-term storage.

Similarly, the transfer evolution for GTCC legacy and segmentation waste described below will be conducted in accordance with rigorously controlled processes to maintain the highest level of radiological and industrial safety:

- The temporarily sealed HI-TRAC, with the loaded NFWC still inside, will be placed on the LPT and moved out of the FHB.
- The HI-TRAC containing the NFWC will then be lifted off the LPT by the VCT and slowly transported from the FHB to the ISFSI area. The HI-TRAC containing the NFWC will then be lowered into a HI-SAFE dry cask already placed in the CTF (refer to Figure 4-44).
- Once placed on top of the HI-SAFE cask, the HI-TRAC temporary sealing will be removed, and the NFWC will be lowered from inside the HI-TRAC down into the HI-SAFE. A lid will then be installed on the HI-SAFE dry cask. The HI-SAFE dry cask containing the loaded NFWC will be lifted out of the CTF pit by the VCT and moved to its on-site storage location in the ISFSI, where it will be secured to the concrete pad with anchor bolts for long-term storage.

Figure 4-44: Cask Transfer Facility (CTF)

Licensing documents, such as the DC ISFSI Updated Final Safety Analysis Report (UFSAR), ISFSI Technical Specifications, and the site-specific license will need to be updated to reflect the storage of damaged fuel, fuel debris, and GTCC waste at the ISFSI (see Section 4.1.1.1.1). Due to the use of compressed gases for the storage canisters' vacuum and drying processes, a PTO will be required for the loading and transfer of spent fuel and GTCC waste to the ISFSI.

PG&E reviewed relevant industry OE and benchmarking results associated with transferring spent fuel and GTCC waste from DCPP and other nuclear power plants (such as Sequoyah in Tennessee, Byron in Illinois, etc.). As a result of these reviews, mitigating strategies (such as procedural upgrades, equipment improvements, work practice improvements, etc.) have either already been implemented or are planned for implementation before spent fuel and GTCC waste are transferred to the ISFSI. Examples of relevant OE and the mitigating strategies put in place are:

- OE27975: "Transport Vehicle (Crawler) Filter Failure during Dry Cask Storage Activities" due to filter housing bolts being over-torqued during installation. No specified torque value was provided in the vendor manual. DCPP revised Transporter OM manual 6021754-31 to include torque limits on the hydraulic filter bolts.

- OE29447: "Inadvertent Dilution of Boron Concentration During MPC Decontamination" due to inattentive error by MPC loading/rinsing/sampling personnel and insufficient procedure detail for when to grab the concentration sample during MPC initial pump down. DCPP revised procedure RP RPI-2 Task Guidance so that the potential for dilution is more positively controlled through improvements in sampling, standpipe, and vent and drain port rinsing and added this event to future pre-job briefs for this work activity.
- OE32411: "Dry Cask Storage Annulus Cooling Chiller Found Tripped" due to ISFSI project roles and responsibilities not being effectively implemented. This resulted in failure to adequately challenge the plan to leave the chiller in operation without monitoring and failure to properly elevate the plan to the proper management decision maker. At DCPP, vacuum drying was eliminated as an option for storing high-burnup fuel per a license amendment request, and a supplemental cooling system was added to cool the MPC in the HI-TRAC by maintaining water in the annulus.

An option has been evaluated to use a dry cask storage system other than the Holtec International HI-STORM 100 System currently in use. Refer to Section 3.5.3 for a discussion of this option.

Options evaluated for transfer equipment included:

- Use a second HI-TRAC transport cask to expedite the off-site transfers (although this supports a reduction in the overall transfer execution duration, it does not mitigate the impacts of a failure of the VCT on the overall transfer execution duration).
- Procure a second redundant VCT to ensure this capability is maintained during transfer execution in the event of a malfunction of the current transporter (this helps reduce the time it takes for the overall transfer, as well as mitigates the impacts of a failure of the VCT on the overall transfer execution duration).
- Modify the ISFSI to add a second cask transfer facility pit, potentially expediting the transfer activities (although this helps reduce the time it takes for the overall transfer, it does not mitigate the impacts of a failure of the VCT on the overall transfer execution duration).

The results of the feasibility of these options are as follows:

- It was determined that the risk of being completely reliant on an aging, critical piece of equipment was unacceptable. This risk was the primary factor in recommending that a second VCT (like-for-like) be purchased prior to the SFP to ISFSI transfers in 2030. In addition, the concurrent use of a second VCT during transfer activities reduces the time required for the overall transfer. If a VCT failure were to occur during the on-site transfer process, this would cause significant critical path decommissioning schedule delays. While the existing VCT will be maintained, the use of a second VCT will provide a significant measure of defense-in-depth by ensuring that at least one functional VCT will always be available during the on-site transfer process. Therefore, a second like-for-like VCT will be procured and commissioned prior to the start of the SFP to ISFSI transfers in 2030.

To provide protection for the VCTs from the coastal environment, a new VCT storage building will be required to be built. The current building that houses the existing VCT isn't large enough to house a second VCT.

PG&E plans to construct a building sized to store two VCTs on the foundation of the existing OSGSF. The location of the new VCT storage building will be east of the ISFSI, out of the coastal zone, and is shown below in Figure 4-45.

Figure 4-45: Location of New Vertical Cask Transporter Storage Building

The costs directly incurred by spent fuel transfer operations during the spent fuel and GTCC waste transfer activities include the following (the cost for procurement of spent fuel and GTCC storage canisters and storage casks is noted in Section 4.1.2.3.2):

- Regulatory compliance and inspections staffing (e.g., NRC-required reporting or inspections)
- Procurement of a second VCT
- Specialized work requiring contracts (such as consultant services, canister helium leak testing, transfer execution equipment operation and maintenance, and transfer equipment certifications)
- Equipment inspections prior to and during transfer activities

The costs indirectly incurred by Spent Fuel Transfer Operations during the spent fuel and GTCC waste transfer activities include infrastructure improvements, materials and consumable costs, and staffing resource costs related to:

- Radiation protection personnel support
- Facility equipment operations (such as the Fuel Handling Building crane)

- Facility and non-transfer equipment maintenance during transfer activities
- Infrastructure improvements (addition of a storage building for the long-term storage of two VCTs);
- The revision of existing procedures
- Licensing and permitting revisions that are required
- Security during transfer activities
- Engineering support during transfer activities (review cask loading information and develop the cask loading plans)
- Project oversight and administration

The indirect staffing costs for operations, maintenance, and security are reported elsewhere in Sections 4.1.1.9.4, 4.1.1.9.5, 4.1.1.9.8, 4.1.2.6.4, 4.1.2.6.5, and 4.1.2.6.8. Other significant contributors to indirect costs reported elsewhere include infrastructure improvements, procedure changes, licensing and permitting changes required for storage and transfer activities, engineering, and project oversight. These costs are reported in Sections 4.1.1.9.14, 4.1.1.9.10, 4.1.1.9.12, 4.1.1.9.13, 4.1.1.9.3, 4.1.1.9.1, 4.1.2.6.14, 4.1.2.6.10, 4.1.2.6.12, 4.1.2.6.13, 4.1.2.6.3, and 4.1.2.6.1.

4.1.2.3.2. Spent Fuel Casks

This section describes the procurement of canisters and casks necessary to safely transfer and store spent fuel, damaged fuel, and GTCC waste.

As detailed above in Section 4.1.2.3.1, the ISFSI uses the HI-STORM 100 dry cask storage system made by Holtec International to store spent fuel and GTCC waste, called the HI-STORM 100 System. After permanent shutdown, a total of 90 canisters and casks will be required to be procured for all remaining spent fuel and GTCC waste to be transferred from the SFPs to the ISFSI. This includes the cost to procure the canisters and casks required for GTCC segmentation waste (total of eight canisters and eight casks for both units).

After permanent shutdown, the specific procurement activities required are as follows:

- Procurement of 80 MPCs necessary for the transfer of spent fuel and damaged fuel from the Unit 1 and Unit 2 SFPs to the ISFSI and storage of spent fuel and damaged fuel at the ISFSI
- Procurement of 80 HI-STORM casks necessary for the storage of Unit 1 and Unit 2 spent fuel and damaged fuel at the ISFSI
- Procurement of two NFWCs necessary for the transfer of GTCC legacy waste from the Unit 1 and Unit 2 SFPs to the ISFSI and storage of GTCC legacy waste at the ISFSI
- Procurement of two HI-SAFE casks necessary for the storage of Unit 1 and Unit 2 GTCC legacy waste at the ISFSI
- Procurement of eight NFWCs necessary for the transfer of GTCC segmentation waste from Unit 1 and Unit 2 Containment Buildings to the ISFSI and storage of GTCC segmentation waste at the ISFSI

- Procurement of eight HI-SAFE casks necessary for the storage of Unit 1 and Unit 2 GTCC segmentation waste at the ISFSI
- Procurement of other equipment and materials (such as overpack cement, transfer hardware, etc.) necessary for the transfer and storage of Unit 1 and Unit 2 spent fuel, damaged fuel, and GTCC legacy waste

The procurement of canisters, casks, and other equipment and materials must be initiated well in advance of the actual transfer activities described above in Section 4.1.2.3.1 to meet the lead time requirements of the supplier. The necessary canisters, casks, and other equipment and materials must be received before transfer activities to ensure there are no adverse impacts to the transfer costs or critical path transfer schedule.

4.1.2.3.3. Expedited Fuel Offload Implementation

In 2017, PG&E evaluated options to assess pre-shutdown and post-shutdown options and costs for expediting dry cask loading. As discussed in Section 3.5.3, there are one-time standard costs that are required to implement an expedited spent fuel offload strategy at DCPP. The one-time implementation costs include engineering verification of an alternate dry cask storage design; development, submittal, and NRC review of a license amendment request, if required; and the difference in cost to fabricate the new dry cask system (versus current system fabrication costs).

For the purposes of this cost estimate, PG&E assumed that an alternate Holtec spent fuel cask design will be used to implement the expedited spent fuel offload strategy. It is appropriate to assume Holtec will be used because this vendor already has an NRC-approved cask design in use at the DC ISFSI and minimal to no changes would be needed to the existing DCPP or DC ISFSI structures or components. Thus, risk is minimized, and cost estimates are more accurate based on actual DC ISFSI experience. Because the implementation work scope does not include any construction activities, it is assumed that no permitting activities will be required.

This scope supports both Unit 1 and Unit 2 decommissioning (approximately 1,261 spent fuel assemblies from Unit 1 and 1,281 spent fuel assemblies from Unit 2 remaining in the SFPs after the 2018 loading campaign through end of operations); the costs are split evenly between the two units. Cost estimates were developed based on discussions with Holtec and PG&E personnel with DC ISFSI and industry dry cask storage experience, as discussed in further detail below. The total expedited spent fuel strategy one-time implementation cost is included in Spent Fuel Transfer Operations in Table 4-1.

Technology for dry cask storage is continuously improving, and the potential for shorter spent nuclear fuel cooling times are expected. PG&E plans to identify any potential improvements in cooling time duration through the requests for proposal process to select a dry cask storage system vendor to expedite the spent nuclear fuel offload process. Non-PG&E staffing portions of the cost estimate are discussed below:

Engineering Verification and Licensing Documentation Preparation

A complete engineering verification of an alternate spent fuel cask design for use at the DC ISFSI and preparation of associated licensing documentation will need to be performed before implementation. This engineering verification and preparation of associated licensing documentation is assumed to be completed by the chosen dry cask storage vendor and will be completed over a one-year period.

NRC Document Review and Approval

The NRC will review the license amendment request or other licensing documentation required to use an alternate spent fuel cask design at the DC ISFSI. NRC hourly review fees are established annually for each fiscal year (FY) in existing regulations. For FY 2017, NRC hourly fees are $263 (Reference 4.10). Based on previous experience with NRC reviews of DC ISFSI-related documents, it is assumed that the NRC review will take two years.

Number of Spent Fuel Casks Required

The cost of purchasing spent fuel casks is included in Section 4.1.2.3.2. An alternate spent fuel cask for expedited fuel offload carries an additional cost of approximately [redacted]. Based on loading scenarios, it is assumed that 80 alternate spent fuel casks may be required.

4.1.2.4. Waste Transportation and Disposal

4.1.2.4.1. Waste and Transportation Management

The Waste Management and Transportation organization has responsibilities in all three phases of decommissioning: license termination, site restoration, and spent fuel management. While the source of the waste may be different in the three phases, the responsibilities for the group are the same. The details of Waste and Transportation Management are in Section 4.1.1.7.

The total cost of Waste Transportation and Disposal during the spent fuel management phase is provided in Table 4-1.

4.1.2.4.2. Solid Radioactive Waste

Solid radioactive waste will need off-site transportation and disposal in all three phases of decommissioning: license termination, site restoration, and spent fuel management. While the source of the waste and quantities may be different in the three phases, how the waste is classified, transported, and disposed of is the same. The details of solid radioactive waste are in Section 4.1.1.7.2.

4.1.2.4.3. Liquid Radioactive Waste

No liquid radioactive wastes are estimated for this phase of work. While the source and quantities of the waste may be different in the three phases, how the waste is classified, transported, processed, and disposed of is the same. The details of liquid radioactive waste are in Section 4.1.1.7.3.

4.1.2.4.4. Hazardous and/or Regulated Material

Hazardous waste transportation and disposal is the off-site shipment and final burial of hazardous waste from the DCPP site. This activity starts when the waste is placed on the transport truck and ends when it is disposed of at the disposal site.

Hazardous waste will need off-site transportation and disposal in all three phases of decommissioning: license termination, site restoration, and spent fuel management. While the source and quantities of the waste may be different in the three phases, how the waste is classified, transported, processed, and disposed of is the same. The details of hazardous waste are in Section 4.1.1.7.4. During this phase of work, hazardous material will be mainly focused on contaminated soils remediation.

4.1.2.4.5. Non-detectable Material (Clean Waste)

Clean waste will need off-site transportation and disposal in all three phases of decommissioning: license termination, site restoration, and spent fuel management. While the source and quantities of the waste may be different in the three phases, how the waste is classified, transported, processed, and disposed of is the same. The details of clean waste are in Section 4.1.1.7.5. During this phase of work, the clean waste is from ISFSI site restoration activities. Clean materials include, but are not limited to, concrete, soils, and metals.

4.1.2.5. Materials Management

4.1.2.5.1. Materials Management

There exists a need for materials management in all three phases of decommissioning: license termination, site restoration, and spent fuel management. While the source and quantities of the assets and commodities may be different in the three phases, how the items are classified, resold, repurposed, or recycled is the same. The details of materials management are in Section 4.1.1.8.1. The main focus of materials management in this phase of work will be during ISFSI site restoration activities for reuse of concrete on-site and rebar recycling.

The total cost of materials management during the spent fuel management phase is provided in Table 4-1.

4.1.2.6. Support Services

4.1.2.6.1. Project Management

The DCPP decommissioning management staff is responsible for ensuring the development and implementation of decommissioning budgets, plans, and schedules that result in the safe and cost-effective decommissioning and restoration of the DCPP site. The management team has responsibilities in all three phases of decommissioning: license termination, site restoration, and SFM. The details of project management ramp-up and ramp-down are in Section 4.1.1.9.1.

The project management costs are those costs attributed to the management team as described in Section 4.1.1.9.1. The cost for the Security and Emergency Services Director is, in part, attributable to SFM. The fraction assigned to SFM changes with the scheduled activities. For example, from Unit 1 shutdown to Unit 2 shutdown, 10 percent of the costs are for SFM; from Unit 2 shutdown to completion of transfer of SNF to the ISFSI, 50 percent of the costs are for SFM; and after completion of transfer of SNF to the ISFSI, 100 percent of the costs are for SFM. The total cost for the Security and Emergency Services Director that are attributable to SFM provided in Table 4-1.

4.1.2.6.2. Project Controls

Project Controls includes a wide array of accounting, cost control, and scheduling activities needed for the planning and execution of a large project such as the DCPP decommissioning. Decommissioning support provides the expertise for Document Control and Records Management System (DC/RMS) while the mission of the Project Controls organization is to provide financial oversight of the decommissioning project, including tracking conformance with established budgets and schedules, maintaining financial records, preparing communications pertaining to the financial status of the decommissioning for state and federal regulators, and preparing and submitting required reports to regulatory agencies such as the NRC, CPUC, and DOE.

Business Services has responsibilities in all three phases of decommissioning: license termination, site restoration, and spent fuel management. The details of Business Services' ramp-up and ramp-down are in Section 4.1.1.9.2. While Project Controls is responsible for accounting, cost control, and scheduling associated with SFM, the fraction of time spent on these functions is minimal and, therefore, a separate accounting of the associated costs has not been performed.

The Project Controls activities may be billed to SFM when working on the DOE annual reports, ISFSI Assurance of Funding Letter, and any DOE litigation issues. The Project Controls group will remain engaged in DOE activities until site restoration is completed in May 2038. After site restoration, any residual reporting and litigation responsibilities will be absorbed by the Security and Emergency Services organization. The total anticipated costs for Business Services SFM activities before completion of site restoration are shown in Table 4-1.

4.1.2.6.3. Engineering

Engineering staff will support a wide range of activities, including work planning efforts, PMP development, design change reviews, transition planning, ISFSI and security upgrades, and site restoration planning. Engineering is responsible for reviewing designs and design change packages; verifying calculations; validating project management plans; reviewing work packages; updating drawings; processing any engineering changes to the design basis or licensing basis of the remaining plant; and verifying that documentation of completed work is completed and submitted to records management in a timely manner. Engineering ramp-up and ramp-down is discussed in Section 4.1.1.9.3. The engineering disciplines that will directly support SFM are:

- I&C/Security/Cyber Engineer: This position will staff up prior to Unit 1 shutdown to prepare and evaluate changes that affect the security systems and infrastructure. In particular, this position will be responsible for reviewing the design changes needed to implement the security modifications and for assisting with installation, maintenance, and troubleshooting of security monitoring systems. The position will remain in place until the transfer of SNF and GTCC wastes to the ISFSI is completed.
- Cyber Security Engineer: This position will staff up prior to Unit 1 shutdown to prepare and evaluate changes that affect the cyber integrity of security systems and infrastructure. In particular, this position will be responsible for reviewing, modifying, submitting, and defending licensing and license basis documents to the appropriate regulators. The position will remain in place until the transfer of SNF and GTCC wastes to the ISFSI is completed.
- ISFSI Engineer – This position will staff up prior to Unit 1 shutdown to prepare and evaluate changes that affect the design, installation, and loading of existing and new storage pads at the ISFSI. The position will remain in place until the transfer of SNF and GTCC wastes to the ISFSI is completed.
- Oversight Lead for Security Modifications: This position will staff up prior to Unit 1 shutdown to prepare for and oversee the installation of the security modifications planned for after both units are shut down. The position will remain in place until the completion of the modification installation, which is planned to finish about 18 months after Unit 2 final shutdown.

The cost of Engineering staffing to support SFM is included under Support Services in Table 4-1.

4.1.2.6.4. Operations

Operations personnel are responsible for monitoring and manipulating the mechanical and electrical systems at the plant. The details of the work performed by the Operations group and the ramp-up/ramp-downs are discussed in Section 4.1.1.9.4. Prior to Unit 2 final shutdown, the Operations group will support the preparation and execution of Unit 1 final shutdown, including defueling the unit, draining and de-energizing systems that will not be needed during decommissioning, and preparing for Unit 2 final shutdown. Those activities do not constitute SFM. After Unit 2 final shutdown, the Operations group will dedicate about 75 percent of its time, and therefore 75 percent of the cost, to

SFM. The remaining 25 percent of its time will be attributed to operating the non-SFP systems, tagging, and procedure maintenance.

The cost of Operations staffing to support SFM is included under Support Services in Table 4-1.

4.1.2.6.5. Maintenance

The Maintenance group will be responsible for maintaining critical equipment at the plant and at the ISFSI. The only SFM costs that are incurred by the Maintenance group prior to Unit 2 shutdown are for work performed at the ISFSI under an ISFSI work order or similar document that describes the scope of work performed and the labor used to execute the work, such as routine ISFSI maintenance.

After Unit 2 shutdown, any Maintenance work that supports transferring SNF to either the ISFSI or to the DOE is considered SFM costs. That work will be done under a specialty "turn-key" contract that describes the scope of work performed and the labor used to execute the work. This includes the monitoring and packaging of SNF for the transfer.

Maintenance of fuel-specific critical equipment such as SFP cooling equipment is expected to consume 25 percent of the Maintenance group's time. Because maintenance management oversight and maintenance are predominantly needed for maintaining non-SFM equipment at the site, most of the costs of Maintenance group staffing are noted in Section 4.1.1.9.5.

The cost of Maintenance group staffing to support SFM is included under Support Services in Table 4-1.

4.1.2.6.6. Radiation Protection

RP staffing provides support for the site in general (non-discrete). The RP organization that is non-discrete is divided into six functional areas:

- Field oversight coverage
- Chemistry
- Dosimetry
- Count Room and effluents
- Instrumentation and respiratory protection
- ALARA and decommissioning job coverage

Most of the RP positions will support activities associated with license termination. Because a major portion of their assignments are for license termination or site restoration and because the positions are required for decommissioning, their costs are associated with license termination or site restoration. The details of the RP assignments and ramp-up/ramp-down schedules are discussed in Section 4.1.1.9.6.

4.1.2.6.7. Final Status Survey

In order to terminate the 10 CFR 50 licenses in the license termination phase, the entire DCPP area of the PG&E property must be systematically surveyed and records generated for submittal to the NRC.

The costs for FSS to support the termination of the 10 CFR 50 licenses are not a part of the SFM effort or costs.

The ISFSI is licensed by the NRC under 10 CFR 72. After the SNF and GTCC wastes have been transferred to the DOE, the ISFSI will be demolished, a FSS performed, and the site restored. The costs for those efforts are captured in SFM. That work will be done under a specialty “turn-key” contract that describes the scope of work performed and the labor used to execute the work.

4.1.2.6.8. Security

10 CFR Part 73 requires “…the establishment and maintenance of a physical protection system which will have capabilities for the protection of special nuclear material…” The details of the security force efforts and ramp-up/ramp-down of staff are discussed in Section 4.1.1.9.8. In addition to the security force, the Security organization is also responsible for training non-security personnel on programs such as GET and CFH Training. The Security organization functions, not part of the security force, which are attributable to SFM are the:

- CFH Trainer
- RP/EP Trainer

The CFH trainer will develop and implement the training program to educate and qualify CFHs, NCO, and any ancillary position that operate or maintain equipment associated with the SFP. The CFH trainer will be released when the SNF and GTCC wastes have been moved to the ISFSI.

The RP/EP trainer will develop and implement the training program associated with Emergency Preparedness and Emergency Response. This position also will assume responsibilities for GET once any GET instructors are released (as discussed in Section 4.1.1.9.11).

The cost of Security group non-security force staffing to support SFM is provided in Table 4-1

4.1.2.6.9. Safety

The Safety organization is responsible for two main functions: overseeing implementation of the PG&E Safety Program and Fire Protection for the DCPP site. Once the general plant site restoration is completed, the responsibility for the Safety and Fire Protection programs will be transferred to the Security organization. The ISFSI is mainly a concrete and steel facility with only minimal fire loading (i.e., minimal potential or severity for fires). Thus, the security force will be trained to address incipient fires and will rely on mutual aid contracts for fires that require a greater response. None of the safety costs are attributable to SFM.

4.1.2.6.10. Procedures

The current operating procedures may or may not meet the need for safe implementation of work at a shutdown facility. Many currently active procedures will no longer be required and will, therefore, be retired. The remaining active procedures will likely need to be revised to reflect the shutdown condition. New procedures that address specific shutdown conditions will need to be written. All of the procedures will need to be evaluated at several milestones including final unit shutdown, completion of fuel and GTCC transfer to the ISFSI, completion of license termination, and completion of site restoration. The procedure effort is required regardless of phase and is accounted for elsewhere. None of the costs of procedure writing or maintenance are attributable to SFM.

4.1.2.6.11. Training

The training staff needed to support the transition from power operations to decommissioning will be part of the Security organization. The training staff will be focused on:

- The continued training and qualification of security officers needed to protect and control access to the shutdown unit(s)
- Training procedure revisions
- Revision or elimination of existing training programs
- Creation of a new CFH training program

The existing operational training organization will continue to maintain the current training programs, such as Licensed Operator Training and GET, for the operational units. The decommissioning training organization will begin to assume training implementation responsibilities as the Unit 1 shutdown approaches and will fully own all training shortly after Unit 2 shutdown. The training costs for Security, including GET, are noted in Section 4.1.2.6.11. The only training costs attributable to SFM are the cost to develop and implement the CFH training program.

The cost to support SFM is provided in Table 4-1.

4.1.2.6.12. Regulatory Management

It's important to manage interactions with regulatory agencies such as the NRC and the CCC to ensure that all parties have a common understanding, all requirements are met, and any issues are identified early and resolved before they cause safety, schedule, or cost adjustments. Regulatory changes will be required at multiple milestones throughout the decommissioning process. Managing the interactions is a coordinated effort by personnel with expertise in licensing issues, permitting, legal, and emergency preparedness. The cost of staffing for Regulatory Management is mainly in the license termination phase. However, there will be a small effort to prepare for and to terminate the 10 CFR 72 site-specific license. That effort is attributable to SFM and the cost is provided in Table 4-1.

4.1.2.6.13. Permit Preparation and Agency Reviews

In addition to the PG&E permitting team, contractors will assist in the accurate and timely preparation, processing, and completion of permit conditions that are critical to the start of execution activities and the completion of license termination. Contractor activities include data collection, the completion of environmental studies, development of a project description, development of application documentation, environmental impact assessments, the fulfilment of permit conditions, and conducting environmental compliance monitoring and reporting, depending on the permit. Costs associated with discretionary permit mitigations are currently unknown and will be determined as part of the permit application and CEQA processes. Therefore, these costs are not included in the permitting cost estimates.

Applicable activities have been identified for each permit, and the related costs for major discretionary and environmental permits are estimated based on a combination of benchmarking of similar projects, subject matter expertise, and experience.

In addition to these contractor labor costs, some agencies charge an agency review fee that is a labor-based fee depending on the amount of review time required by the agency to review and process the permit. These are not set fee amounts. Each estimated agency review rate has been determined for major discretionary and environmental permits through either published rates or benchmarking from previous reviews by the agency. Similarly, the anticipated agency review times were estimated through the benchmarking of similar permit reviews.

The permit contractor labor and agency review costs have been evaluated for applicable work scope covered in license termination, spent fuel management, and site restoration. Based on the assessment, one-third of the permitting contractor labor and agency review costs have been applied to spent fuel management.

4.1.2.6.14. Public Relations

Stakeholders have a vested interest in the safe, effective, and efficient completion of all decommissioning activities. Stakeholders include PG&E shareholders, employees, local community members, local government, state regulators, and federal regulators. Stakeholder interests range from continued employment opportunities to the radiological consequences of decommissioning activities to environmental impacts of previous plant operations and the site environmental end-state condition.

Several key positions will facilitate the plethora of communication opportunities: employee communications, Governmental Relations, and Public Relations. The cost of these positions and the public relations effort is principally in the license termination phase. However, there will be a small effort to support activities associated with the termination of the 10 CFR 72 site-specific license and site restoration. That effort is attributable to SFM and the cost is provided in Table 4-1.

4.1.2.6.15. Specialty Contracts

The specialty contracts scope encompasses maintenance of the site infrastructure that will accommodate the spent fuel storage facility through the duration of the decommissioning project and general support to both PG&E and vendors performing their specific scopes of work. It is further detailed in Section 4.1.1.9.

The specialty contracts scope of the spent fuel management phase will begin after the FSS and the Part 50 licenses are terminated. During this phase it is expected that security forces and a security system will be in place to protect the fuel canisters from harm until the DOE accepts and transfers the final cask off-site. This scope will provide garbage pick-up and janitorial services for the Security Building; payment of the monthly utility charges; payment of the water management contract charges; payment of fuel used by the site security forces; Emergency Preparedness; Emergency Planning fees; NRC fees associated with SFM to transition from Part 50 to Part 72-only license; property tax; and property and liability insurance. All of these scopes will continue to the end of site restoration.

Provisions for tools, equipment, supplies, and specialty contracts will be handled based on the contracting strategy. Specialty Contracts vendors will maintain the security and building systems; provide required testing and analysis; and procure materials to support the security staff, shooting range, and replacement security devices.

4.1.2.6.15.1. Facilities, Garbage, and Janitorial

Facilities

Tools, Equipment and Supplies include:

- Tools, Equipment and Supplies. General tools, equipment and supplies will be minimal and provided only for the security personnel overseeing the spent fuel canisters and shooting range.
- Specialty Tools and Equipment. Will be required to support maintenance and testing of the spent fuel canisters and security devices.
- Health Physics Supplies/RP Tools and Equipment. All HP Services will be provided by a specialty contract to perform periodic testing and inspections of the spent fuel canisters.
- Services, Supplies, and Consumables. Recurring costs associated with essential services to support the spent fuel management and Security staffing organizations, general office supplies, insurance costs, plant energy, property taxes, NRC fees, emergency planning fees, environmental sampling analysis, janitorial services, landscaping services, building maintenance services, portable toilet rental and maintenance, temporary lighting and trash and refuse collection. Also included are services for signage, furniture rental, employee travel for training, communications services, and Industrial Security services, as well as services provided by vendors with scopes of work and costs that fall outside of the major project scopes.

Specialty contracts include consultation services beyond regular staffing and will be required to manage the disparate activities and needs. Consultation services are expected to be proportional to the remaining site restoration scope. Examples of the services that will be needed include:

- Project oversight SME consultation services
- Onsite emergency medical care via remote physician
- Heating, ventilation, and air conditioning maintenance and repair

- Legal representation to support the NDCTP and CPUC proceedings
- Implementation of site restoration plans, including permitting mitigation plan
- Site insurance and property taxes
- Shooting range maintenance services
- Other services to support emergent requirements and issues

Garbage

- Trash and recycling service will be provided to the site, similar to current services. Dumpsters will be provided for trash and recycling materials with pickups scheduled as needed. Containers also will be provided for battery and lightbulb disposal, with an appropriate pickup schedule. Costs for trash services are expected to be proportional to the site staffing levels.

Janitorial

- Janitorial services will be limited to the remaining PG&E facilities which should be minimal or in the process of demobilization. This service also will empty trash and recycling containers and dispose of refuse in the dumpsters provided. The cost of these services is expected to be proportional to the site staffing levels.

4.1.2.6.15.2. Utilities

After the Part 50 licenses have been terminated, the only permanent building expected to remain is the new Security Building. Utilities will be provided to continue the operation of the ISFSI monitoring and protection systems and to power the new security building systems and to support the decommissioning process.

The electrical systems, both above and below ground will be modified, re-routed, and maintained to provide essential services to the ISFSI and new Security Building.

Electricity

An electric meter will be installed to measure usage, then a new temporary system (see C&D power in Section 4.1.1.2.1) will distribute power as required using new and existing electrical systems. The electricity will power security functions at the ISFSI and Security Building, radiation monitoring, lighting, and building systems within the Security Building related to habitability.

Compressed Gasses and Liquids

Compressed and liquid gasses will no longer be required in bulk at the site after the Part 50 licenses are terminated. Pick-up trucks and other site vehicles will be fueled off-site. Any other miscellaneous requirement that may arise will be addressed through a specialty contract.

Domestic and Service Water

Water, both domestic and service will be provided by trucking in tankers of treated water and filling tanks. (see Section 4.1.1.2.2). This water will be distributed through existing, re-routed, or new piping systems as required. Drinking water will be provided by a bottled water service.

Sanitary System

The sanitary system will be limited to holding tank and portable toilet facilities. These systems will be serviced as required.

Site Temporary Accommodations

See Section 4.1.1.9.14.2.

4.1.2.6.15.3. Licenses and Fees

DCPP is required to maintain its licenses, pay taxes, and provide insurance coverage until the ISFSI license is terminated. Licensing fees, Emergency Planning Fees, insurance, and taxes are assessed to DCPP annually. Fees are assessed based on the current license condition or EP participation required. Insurance coverage and rates are established by the corporation. Property tax is based on the depreciated value of the assets in service at the time.

Licensing Fee

The licensing fee is assessed by the NRC; the amount of the fee is established in regulatory guidance. The NRC also charges for labor and expenses related to review of plan changes and other documents as well as its participation in public meetings, both in California and in Washington D.C. regarding DCPP. NRC review fees are expected to remain minimal after the Part 50 licenses are terminated.

Emergency Planning Fees

FEMA and the California Emergency Management Agency along with other local and state agencies all impose fees related to emergency planning and emergency response. EP fees and participation are expected to be minimal after the Part 50 licenses are terminated.

Permitting Fees

Most permits require fees to be submitted at the time of application to cover the cost of processing. Details of the permitting strategy as well as identified permits can be found in Section 3.1. The fee for each permit is a set, published amount by the governing agency and has been determined for each expected major discretionary and environmental permit, as applicable. These application fees are different than the labor-based agency review fees that are covered in Section 4.1.2.6.13.

Permit fees have been evaluated for applicable work scope covered in license termination, spent fuel management, and site restoration. Based on the assessment, one-third of the permitting fees have been applied to spent fuel management.

Property Taxes

Property taxes are calculated based on the booked value of the DCPP assets in service. Current capital assets on PG&E's books and records will be fully depreciated to zero by 2026, so will not add value to the property tax base. Any spending on future tangible personal property used in the decommissioning process will be funded by the DCPP NDT. These dollars are generally expensed by the company and will not add value to the property tax base. Current facilities and new facilities related to the dry cask and spent fuel storage are funded by the DCPP NDT. These dollars are generally expensed by the company and will not add value to the property tax base. To the extent these dollars are capital dollars spent by the utility, spent fuel is generally viewed as contaminated property and will contribute little to no value to the property tax base. The land that PG&E owns and the land that it leases from Eureka Energy will continue to be used in the same manner as today until the decommissioning process is completed. The estimated property taxes based on FY2018/2019 land values and FY2017/2018 tax rate is approximately $725,000 per fiscal year, July 1 through June 30.

Property and Liability Insurance

Property and liability insurance policies and coverage strategies are developed by the corporation. The corporation has provided premium information based on the current Liability, Nuclear Liability Adjustments, Property, Nuclear Property Adjustments and Government Indemnity Insurance premiums as:

- $6M per year while the reactor is shutdown and defueled; SNF may exceed 565°C and is susceptible to cladding fire
- $350,000 once SNF can no longer exceed 565°C; SNF is no longer susceptible to cladding fire; significant inventory of mixed radioactive material remains on-site
- $250,000 when all SNF is at the ISFSI or until all casks are transported off-site to the DOE-approved storage facility.

4.1.2.7. GTCC Management

4.1.2.7.1. GTCC Storage Operations

After the Part 50 License is terminated, GTCC Storage Operations will be accounted for as a Spent Fuel Management cost. The details of the GTCC Storage Operations are in Section 4.1.1.5.2.

4.1.2.7.2. GTCC Waste Disposal

It is not anticipated that the DOE or another independent facility will accept the GTCC waste prior to the transfer of spent fuel. Therefore, the cost of the GTCC disposal is shown in the final years of ISFSI operations.

4.1.3. Site Restoration

4.1.3.1. Balance of Site Restoration

4.1.3.1.1. Soil Remediation

The first step in site restoration is soil remediation, which is the process of excavating and removing chemically and radiologically contaminated soil to the level where remediated soils meet chemical and radiological cleanup criteria. This step will start when contaminated soil is first moved and may take place before, during or after DCPP demolition activities; it will be completed when cleanup criteria have been met and the area is ready for FSS. Soil remediation will take place within the approximately 750-acre plant site, and the extent of soil contamination within the site will be defined by the Site Characterization Study. Soil remediation is carried out to reduce soil contamination to levels that meet NRC's radiological release criteria for unrestricted use and DTSC's chemical cleanup standards.

Soil remediation includes the logistical, planning, resources, and physical work required to excavate contaminated soils in conjunction with demolition, excavation, and final site restoration activities. Soil remediation equipment will include shovels, backhoe and trackhoe excavators. During remediation, soils are sampled to determine if contamination levels are below the Derived Concentration Guideline Level (DCGL) and to determine the appropriate disposition (e.g., reuse for backfill or hauled off-site and transported to waste disposal sites). During remediation, additional investigations will be performed to ensure that any changing soil contamination profile is adequately identified and addressed. Soil remediation for hazardous materials includes, but is not limited to, asbestos, lead, lead-based paint, PCBs, and contaminated underground plumes. Soil remediation for radiological constituents, such as Cesium-137, is carried out to reduce residential radiological contamination to levels that meet NRC's annual dose limit of 25 mrem.

During demolition and excavation activities, additional areas of contamination not identified during site characterization may be discovered that require additional soil remediation efforts, and regulatory requirements for remediation also might change, imposing more stringent final cleanup standards.

The planning process costs will be comprised primarily of development of remediation plans and overhead staffing costs. Once the remediation plans are approved, the tools and equipment necessary to support Soil Remediation will be procured. During soil remediation, surveys will be completed to determine whether areas have been remediated and are ready for FSS. Any required discretionary or environmental permits are described in Section 4.1.3.5.12.

The costs directly incurred by soil remediation include:

- Development of remediation plans
- Obtaining ministerial permits
- Obtaining tooling, equipment (e.g., shovels, backhoe, and excavator), and laboratory facility
- Civil work to excavate, segregate, and stockpile contaminated soil under a soil management plan.
- Surveys to confirm that cleanup criteria have been met and areas are ready for FSS
- Evaluation of samples in laboratory
- Additional civil work to further remediate areas that do not meet cleanup criteria
- Regulatory compliance and inspections staffing (California Department of Toxic Substances Control or NRC required reporting or inspections)
- Mobilization and demobilization costs

The soil remediation cost estimate is included in site restoration in Table 4-1.

4.1.3.1.2. Final Status Survey

To terminate the 10 CFR Part 50 licenses, the entire DCPP area of the PG&E property must be systematically surveyed via a FSS for radiological contamination. The FSS are designed to demonstrate to the NRC that licensed radioactive materials have been removed from the site to the extent that the remaining radiological contamination is below the radiological criteria for unrestricted release. The FSS will take place within the 750-acre DCPP site.

The Final Status Surveys are rigorous, requiring specialized skill sets and substantial and accurate documentation under a quality-related program. The FSS are carried out pursuant to a Final Survey Plan, which is developed using guidance provided in the MARSSIM pursuant to NUREG-1575. This document provides a consistent approach used by EPA, NRC, DOE, and DOD. Following the MARSSIM approach provides assurance that the requirements of all four agencies will be met. The document incorporates the statistical approaches to survey design and data interpretation used by the EPA. It also identifies state-of-the-art, commercially available instrumentation and procedures for conducting radiological surveys. Use of this guidance ensures that the surveys are conducted in a manner that provides a high degree of confidence that applicable NRC criteria are satisfied.

FSS activities for particular areas will take place after remediation surveys or equivalent evaluations have been performed to confirm that soil remediation was successfully completed. Remedial surveys, turnover surveys, or equivalent evaluation for areas not requiring further remediation may be performed using the same process and controls as FSS so that data from these surveys may be used as part of the FSS data. After confirming that a particular area has been successfully remediated, the area will be isolated and controlled to ensure that radioactive material is not reintroduced from nearby activities and to maintain its “as left” condition. Tools and equipment that would impede the survey are removed to ensure that the area is free of obstruction.

Once all surveys and site restoration are essentially complete, PG&E must generate a summary report on the overall FSS results, comparing the data not only to the guidelines established in the LTP, but also to the generic guidelines in the EPA memorandum of understanding with the NRC. Along with this report will be a request for termination of the 10 CFR Part 50 licenses for the DCPP Units 1 and 2. The NRC will evaluate the information, may request an independent confirmation of radiological site conditions, and will make a determination on final termination of the licenses.

PG&E is also heeding a key lesson learned from the HBPP Decommissioning FSS program – ensuring that the remedial surveys, turnover surveys, or equivalent evaluation for areas not requiring remediation are performed using the same process and controls as FSS so that data from these surveys can be used as part of the FSS data.

The planning process costs will be comprised primarily of development of FSS plans and overhead staffing costs. Once the FSS plans are approved, the tools and equipment necessary to support FSS will be procured. During FSS, samples will be collected and tested, and statistical analyses will be conducted to determine whether areas meet NRC release criteria. Any required discretionary or environmental permits are described in Section 4.1.3.5.12.

The costs directly incurred by FSS include:

- Development of FSS plans
- Obtaining ministerial permits
- Obtaining tooling, equipment (e.g., shovels, backhoe, and excavator), and laboratory facility
- Sample collection via FSS
- Evaluation of samples in laboratory
- Statistical analysis to verify whether areas meet NRC release criteria
- Additional FSS sampling, collecting, testing, and analysis
- Regulatory compliance and inspections staffing (NRC-required reporting or inspections)
- Mobilization and demobilization costs

The total FSS cost estimate is included in site restoration in Table 4-1.

4.1.3.1.3. Grading and Landscaping

Grading and landscaping is one of the final steps in restoring the DCPP site and marks the end of decommissioning by establishing the site's end state configuration. Grading and landscaping will take place on the plant site, which is confined to a 750-acre area that extends from the Pacific Ocean, east a few hundred yards, climbing to nearly 1,000' above sea level. This includes the areas adjacent to the ocean, to the bluff top between 85' and 140' above sea level and the area located east of the power block in a small canyon (Diablo Creek) about 300' above sea level. Approximately 88 acres will be graded and landscaped (restored).

This section pertains only to the site restoration of DCPP; it does not include site restoration of the ISFSI, 500 kV transmission facilities, and any buildings that are retained to support ISFSI operations. These items are covered under Section 4.1.2.2.4.

The first step in grading and landscaping the DCPP site will be to develop several plans, including a grading and drainage plan, which will identify areas for grading and re-contouring and determine cut and fill quantities and sources; a stormwater management plan; a landscaping plan; and a restoration plan, which will identify areas that will be restored to a natural condition. Once all the required plans have been developed, grading activities will be conducted. This involves backfilling below grade voids with clean fill to provide a reasonably uniform site contour (e.g., no large localized on-site depressions). The next step will be to grade site areas affected by dismantling activities to prevent ponding and to inhibit the refloating of subsurface materials, and to establish natural contours. Soil will then be placed to further establish natural contours, and drainage systems will be rerouted or repaired, stormwater detention basins will be established, and grading will be conducted to maximize the implementation of low impact development measures. Last, fill will be placed over gravel road and parking areas.

After grading activities are completed, landscaping and restoration activities will begin. This includes installing erosion control features, adding top soil and ground cover, and planting native grasses, trees and shrubs in areas identified to be restored and/or landscaped. Mulch will then be placed in the restored areas, and areas restored pursuant to the restoration plan. Maintenance activities will be undertaken throughout this process; these include watering (either by hand or with an irrigation system), installing and maintaining plant protections (e.g., fencing and cages) as needed, and mulching, seeding, planting, and weeding in the immediate vicinity of the planted vegetation to reduce competition with non-native plants.

The extent of grading and landscaping required for site restoration was evaluated and a reasonable level anticipated to be required by applicable regulatory agencies to meet restoration goals and objectives was assumed for the site. The HBPP Final Site Restoration Plan was evaluated to determine the expected grading and landscaping requirements for the DCPP lands. The level of restoration that was required by federal, state, and local agencies for HBPP was used as the basis for the assumed level of restoration required for DCPP. For example, the DCPP plan includes removing the fill placed in the Diablo Creek channel after demolition of the 230 kV Switchyard, but it does not assume restoration of the plant site to pre-DCPP construction grades. Achieving pre-DCPP construction grades would require extensive grading and filling that would result in excessive construction requirements will little additional restoration benefits.

Based on this benchmarking, the cost estimates assume restoring the former creek channel after it is removed. CSLC Lease No. PRC 9347.1 also was evaluated, which requires that PG&E remove all or any improvements in accordance with a decommissioning and restoration plan. Based on this, costs were developed to remove the East and West Breakwater and restore the Breakwater areas. Breakwater removal and alternatives are discussed in Section 3.2.

Potential risks and challenges include prolonged periods of drought conditions after landscaping and planting, which would necessitate watering to ensure that vegetation growth meets restoration performance criteria. Additional risks include establishment of non-native vegetation that crowds out native plants and shrubs, which would require additional landscaping and planting; a lack of suitable, on-stream restoration materials, which would require this material to be imported; and lack of Marine Restoration raw materials. Furthermore, if federal, state, or local agencies change their end-of-state vision for the site, that would lead to modified or additional site restoration requirements.

The planning process costs will be comprised primarily of development of grading and landscaping plans and overhead staffing costs. After the grading and landscaping plans are approved, the tools, equipment, and materials necessary to carry out the work will be procured. Grading and landscaping will be carried out per plan specifications. Any required discretionary or environmental permits are described in Section 4.1.3.5.12.

The costs directly incurred by grading and landscaping include:

- Development of a grading plan, stormwater management plan, landscaping plan, and restoration plan
- Obtaining ministerial permits
- Obtaining tooling and equipment (e.g., shovels, backhoe, and excavator), and supplies (e.g., seeds, plants, topsoil, mulch)
- Conducting civil work, including grading, rerouting or repair of drainage systems and establishment of stormwater detention basins
- Conducting landscaping and planting
- Regulatory compliance and inspections staffing
- Mobilization and demobilization costs

The grading and landscaping cost estimate is included in site restoration in Table 4-1.

4.1.3.1.4. Utilities and Structures Demolition

Utilities and Structures demolition involves all structures not covered under Building Demolition and utilities, roads, and parking lots. This step starts when all building demolition and deep excavation activities for a particular area are completed and ends when all remaining utilities and structures have been demolished and removed. It includes demolishing all utilities outside the perimeter of foundations of buildings demolished, all other utilities, parking lots, and 230 kV transmission facilities. It does not include the ISFSI, 500 kV transmission facilities, primary and secondary access roads, and any buildings that are retained to support ISFSI operations (these are covered under Section 4.1.2.2.4.

Specifications, design, drawings, calculations, and work plans required to support the generation of removal plans with an engineering survey will be completed. All utilities and plant system piping beyond the perimeters of the footprints of building and structure foundations and structure walls will be removed to a point 3 ft. below final grade. Internal commodities and components, including any plumbing, piping vaults, tanks, sewer, electrical, HVAC, or other systems and man-made voids will be demolished and removed. This will include security equipment, fences, roads, underground piping or conduit outside the building footprint, fire hose reels or hydrants not attached to structures, exterior lighting, and retaining walls.

Removed or collapsed accessible vaults, electrical pull boxes, and other man-made voids will then be backfilled. The last step will be to break-up and reuse (or dispose per waste management guidance) concrete surfacing of roads and parking areas. Waste generated during the demolition of utilities and structures will be hauled off-site for disposal.

Potential risks and challenges include permitting and other regulatory body changes driven by the agencies or unforeseen events occurring at the site. Examples include regulatory direction to not reuse concrete on site; additional regulatory requirements that result in increased design effort; an increase of special-status plans or protected animals; and discovery of unanticipated contaminated soil or archeological remains.

The planning process costs will be comprised primarily of development of demolition plans and overhead staffing costs. Once the demolition plans are approved, the tools, equipment, and materials necessary to carry out the work will be procured. Utilities and structures will be demolished per plan specifications. Any required discretionary or environmental permits are described in 4.1.3.5.12 Regulatory Management.

The costs directly incurred by Utilities and Structures Demolition include:

- Development of specifications, design, drawings, calculations, and work plans required to support the generation of removal plans with an engineering survey
- Obtaining ministerial permits
- Mobilization, installation, maintenance, and removal of any required BMPs and SWPPP measures
- Obtaining tooling and equipment (e.g., dozer, backhoe, and excavator)
- Conducting civil work, including demolition and removal of facilities, foundation, underground utilities and remaining structures, and filling of voids
- Mobilization and demobilization cost

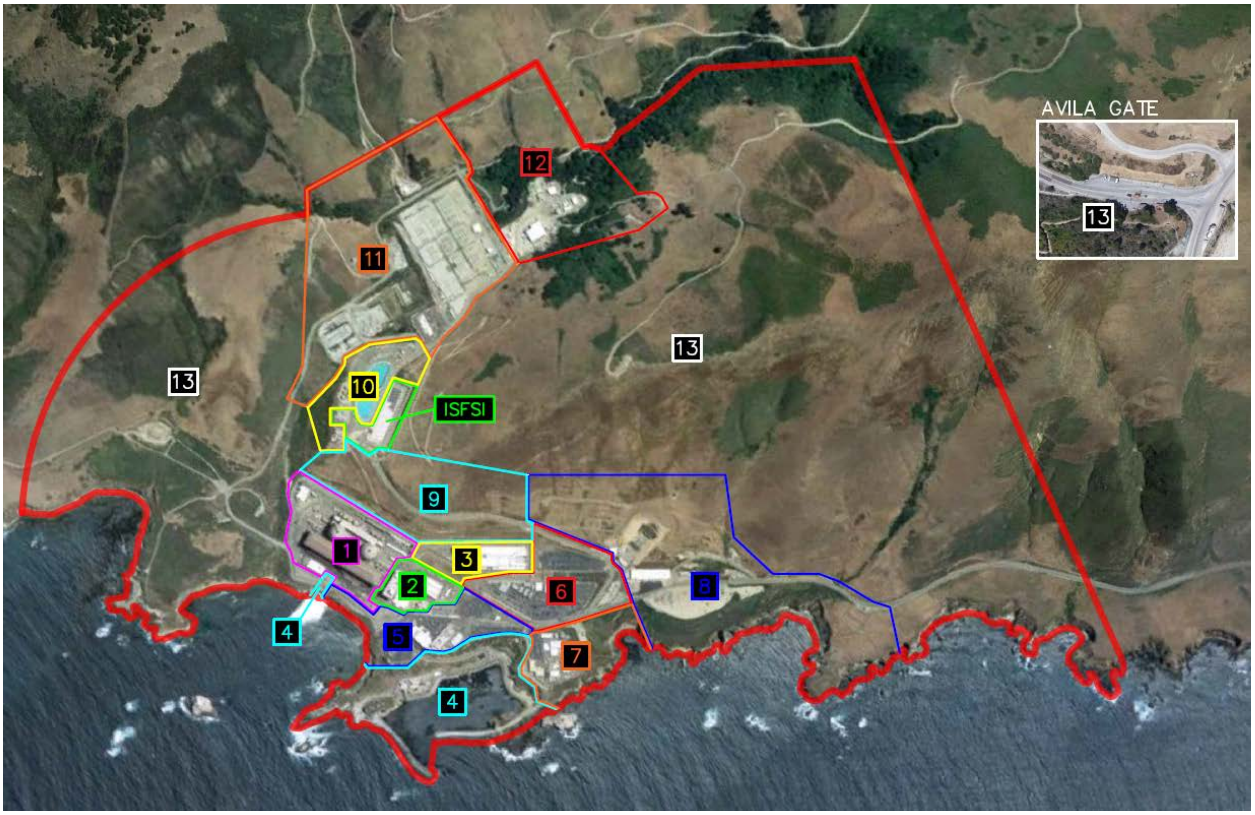
The Utilities and Structures cost estimate is included site restoration in Table 4-1.

4.1.3.2. Building Demolition

4.1.3.2.1. Building Demolition Zone 1

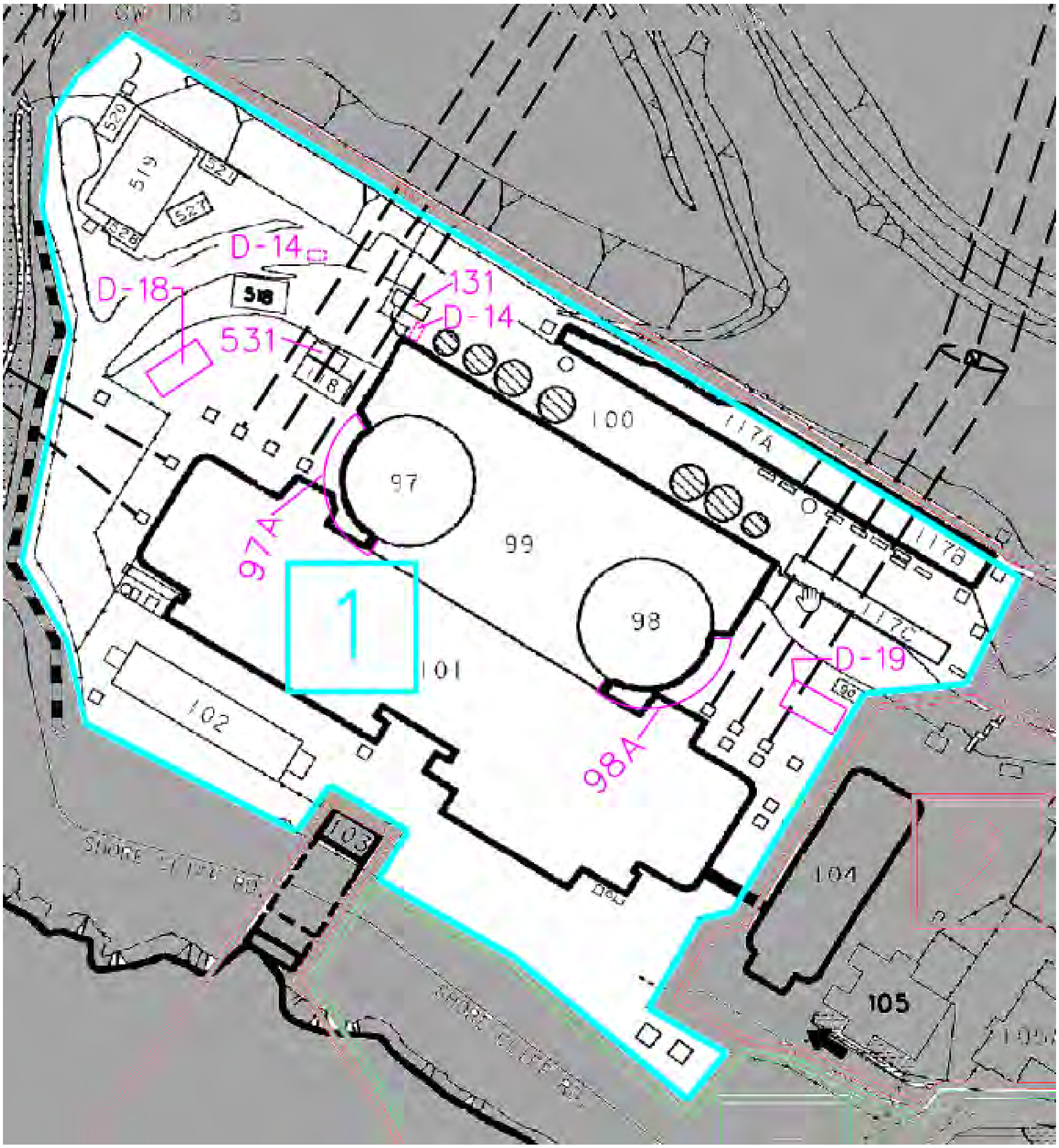
The plant site was divided into zones 1 through 12 to allow for certain areas to be demolished and released in smaller sized pieces. A 13th zone also was created to include all other items outside these 12 distinct zones, as well as larger items that cross multiple zone boundaries (the circuiting water tunnels, for instance). A complete zone map is shown below in Figure 4-46.

Figure 4-46: Detailed Zone Map



Zone 1 consists of an area that encompasses the main power block, as well as buildings located to the north and to the east inside the RCA. See Figure 4-47 for a detailed map of this zone, and Figure 4-48 for relative locations of the plant buildings within the power block.

Figure 4-47: Zone 1 Buildings

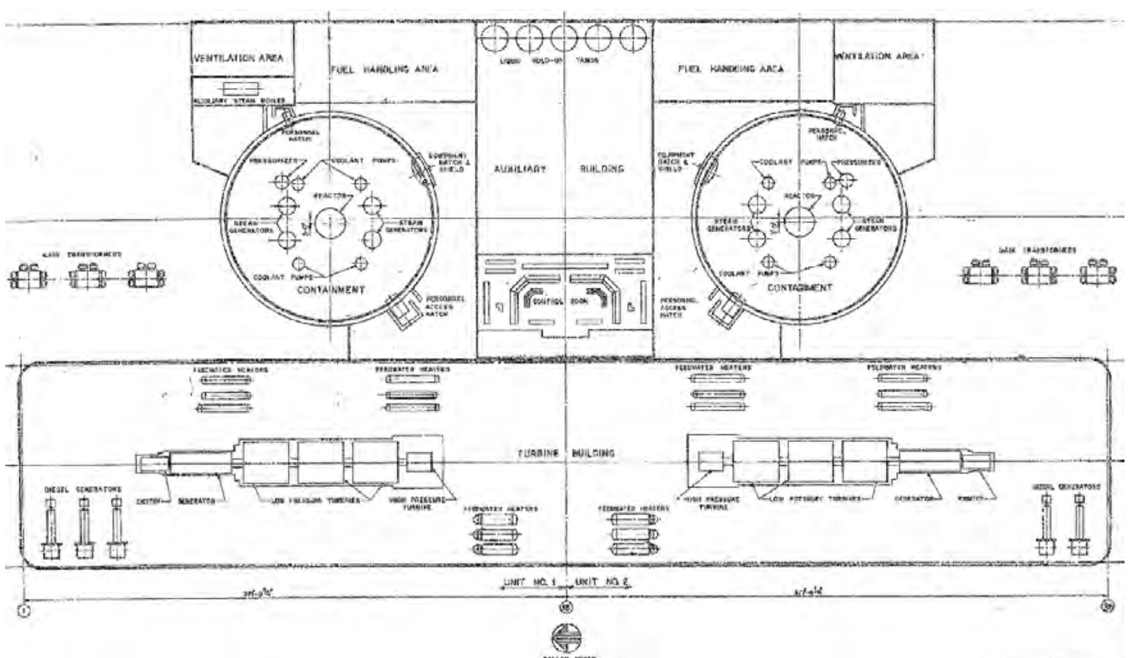


The following is a detailed list of permanent plant structures and facilities within Zone 1 to be demolished:

- Unit 1 and Unit 2 Containment Buildings (Bldgs. 97 and 98)

- Unit 1 and Unit 2 Pipeway Structures (Bldgs. 97A and 98A)
- Auxiliary Building (Bldg. 99)
- Outdoor Water Storage Tanks (Bldg. 100)
- RCA Laundry Facility (Bldg. 117A)
- RCA Radwaste Storage (Bldg. 117B)
- RCA Storage Building (Bldg. 117C)
- RCA Calibration Facility (Bldg. 131)
- Turbine Building (Bldg. 101)
- Unit 1 and Unit 2 Transformer Yard Oil Retention Basins (Bldgs. D-18 and D-19)
- Service Air Building (Bldg. 90)
- I&C/Medical Facility (Bldg. 102)
- Auxiliary Boiler Enclosure (Bldg. 118)
- Craft Facility - Storage (Assembly Building) (Bldg. 518)
- Warehouse A (Bldg. 519)
- Paint Department Facility (Bldg. 520)
- Offices (Bldg. 521)
- Start-up - I&C Craft Shop (Bldg. 527)
- Toilet trailer (Bldg. 528)
- Scaffold Storage Area (Hazardous Waste Handling Area) (Bldg. 531)
- Abandoned Diesel Storage Tanks (Bldg. D-14)

Figure 4-48: Power Block Areas



Building demolition scope for these facilities consists of complete demolition and removal of all structures above grade, and removal of all or some foundations. PG&E performed a study to evaluate and provide recommendations on the extent of foundation removal for each structure. The will be discussed below on a structure-by-structure basis. This study evaluated all foundations on site using three options:

- Option 1 – Partial removal of the foundations to a depth of 3' (minimum) below local grade, with the remainder to be backfilled
- Option 2 – Full foundation removal, regardless of depth
- Option 3 – For some structures, it may be prudent to employ a methodology that is a combination of Options 1 and 2. Because each structure is unique, Option 3 varied on a structure-by-structure basis.

Using the options described above, DCPP structures were evaluated against the following criteria. An excavation option was then recommended for each structure on site.

- Constructability/Feasibility: Is it possible to perform either full removal of foundations or removal to 3' depth
- Engineering – Structural stability and safety (e.g., retaining walls, voids, etc.) concerns
- Final Site Survey Feasibility – NRC regulatory requirements to ensure areas are effectively surveyed and released if foundations are left behind
- Environmental – Environmental regulations that may require sub-grade foundation removal, and associated potential environmental impacts; additional requirements if foundations are not removed
- Permitting – Federal, state, and local agencies’ requirements
- Legal – Liability or other legal considerations; potential lease requirements or restrictions for how the land must be left behind
- Public Involvement – Public feedback based on California nuclear power plant specific experience at HBPP and SONGS
- Benchmarking – Comparison to other sites that have undergone decommissioning, including HBPP, SONGS, Hunter’s Point and Rancho Seco in California; Vermont Yankee Power Plant in Vermont and Zion Nuclear Power Plant in Illinois
- Cost – Relative costs to the customers between various options

As discussed in Section 3.3, PG&E will utilize an approach that removes selected contaminated systems and components from each structure prior to demolition; however, most clean systems and components will remain in their present locations prior to demolishing the structure. Specifically identified systems that will be removed prior to demolishing a structure will be removed during the System and Area Closure scope of work (see Section 4.1.1.6), and specifically identified large components that will be removed prior to demolishing a structure are removed during the Large Component Removal scope of work (see Section 4.1.1.6). Other systems and large components will remain in their present locations and will be removed and downsized for disposal purposes during the demolition of the associated building.

When the demolition phase of a given structure is completed, the area will be turned over to the Final Site Restoration scope of work (see Section 4.1.3.1) for performance of final site survey, backfill, and landscaping activities.

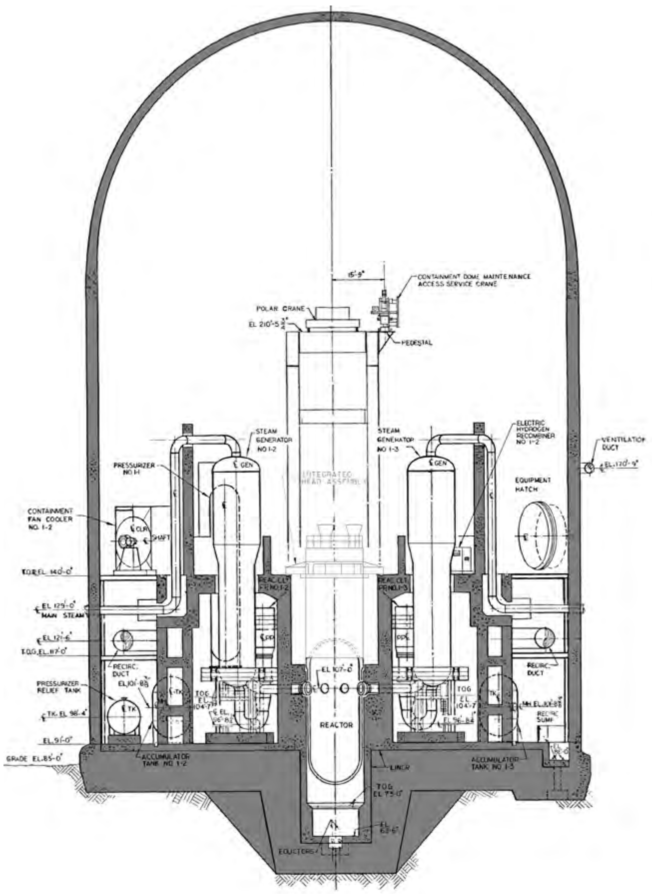
The following topics were evaluated to ensure the maximum level of safety was built into the method and program for demolishing structures:

- The methods for removal of each portion of the Containment Buildings have been specifically chosen to ensure the highest level of safety. Methods are based on benchmarking and previous industry experience gained by the utilization of consultants who have performed nuclear decommissioning projects at other sites.
- All hazardous materials will be removed, or remaining materials will be below allowable limits.
- Open air demolition criteria will be created, and all structures and components will be decontaminated such that these criteria can be maintained during demolition. This may require the use of dust control or other related measures.
- A pre-demolition survey will be prepared that includes engineering reviews of the demolition method and sequence to maximize safety of the operations. All steps of the demolition process at DCPP will be pre-engineered and planned.
- Only qualified heavy industrial demolition contractors will be used, in accordance with PG&E's rigorous contractor oversight policies.

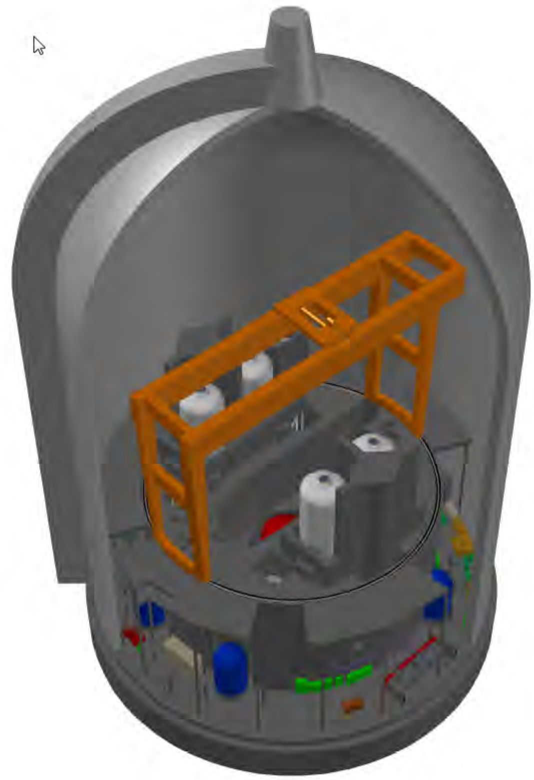
Unit 1 and Unit 2 Containment Structures (Bldgs. 97 and 98)

The containment structure for each unit is a steel-lined, reinforced concrete building of cylindrical shape with a dome roof that completely encloses the reactor and reactor coolant system (RCS); it contains various internal structural elements that support these systems. Refer to Figure 4-49. The containment structure ensures radioactive materials are contained and prevents against release of radioactive materials to the environment under various operational or accident conditions.

Figure 4-49: Containment Structure



U-1 CONTAINMENT -
SECTION LOOKING EAST



U-1 CONTAINMENT
3D VIEW
LOOKING NORTHEAST

The containment structures for Unit 1 and Unit 2 are essentially identical but are mirror images. The following discussion applies to both units:

The exterior shell consists of a 142-ft. high cylinder, topped with a hemispherical dome. (Refer to Figure 4-50.) The minimum thickness of the concrete walls is 3.6 ft., and the minimum thickness of the concrete roof is 2.5 ft. Both have a nominal inside diameter of 140 ft. and a nominal inside height of 212 ft. The concrete base slab foundation is 153 ft. in diameter with a minimum thickness of 14.5 ft., with the reactor cavity near the center. (Refer to Figure 4-51.) The inside of the dome, cylinder, and base slab is lined with welded steel plate, which forms a leak-tight membrane. The nominal thickness of the steel liner is 3/8-inch on the wall and dome and the nominal thickness of the steel liner on the base slab is 1/4-inch.

Figure 4-50: Containment Exterior Shell

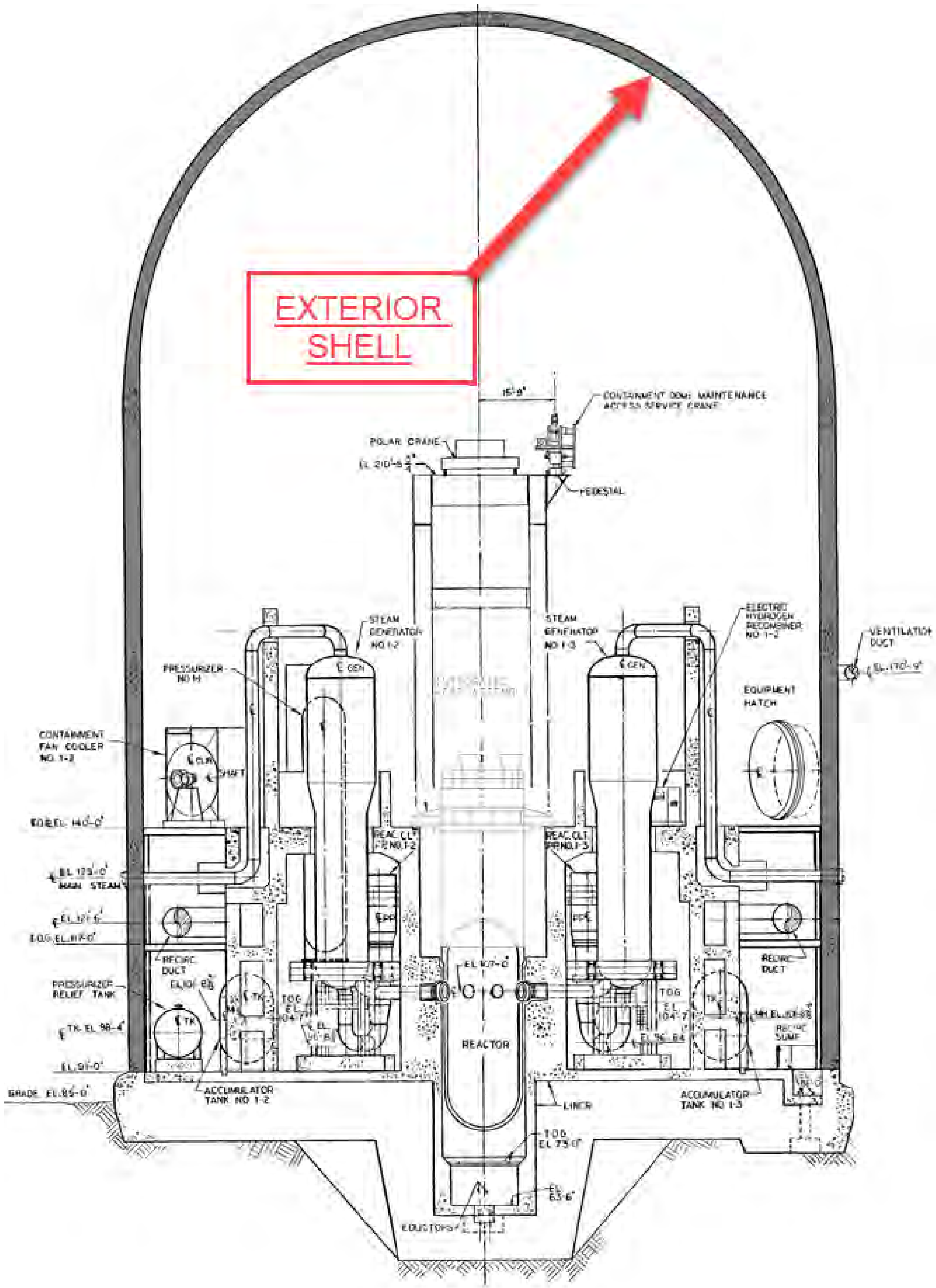
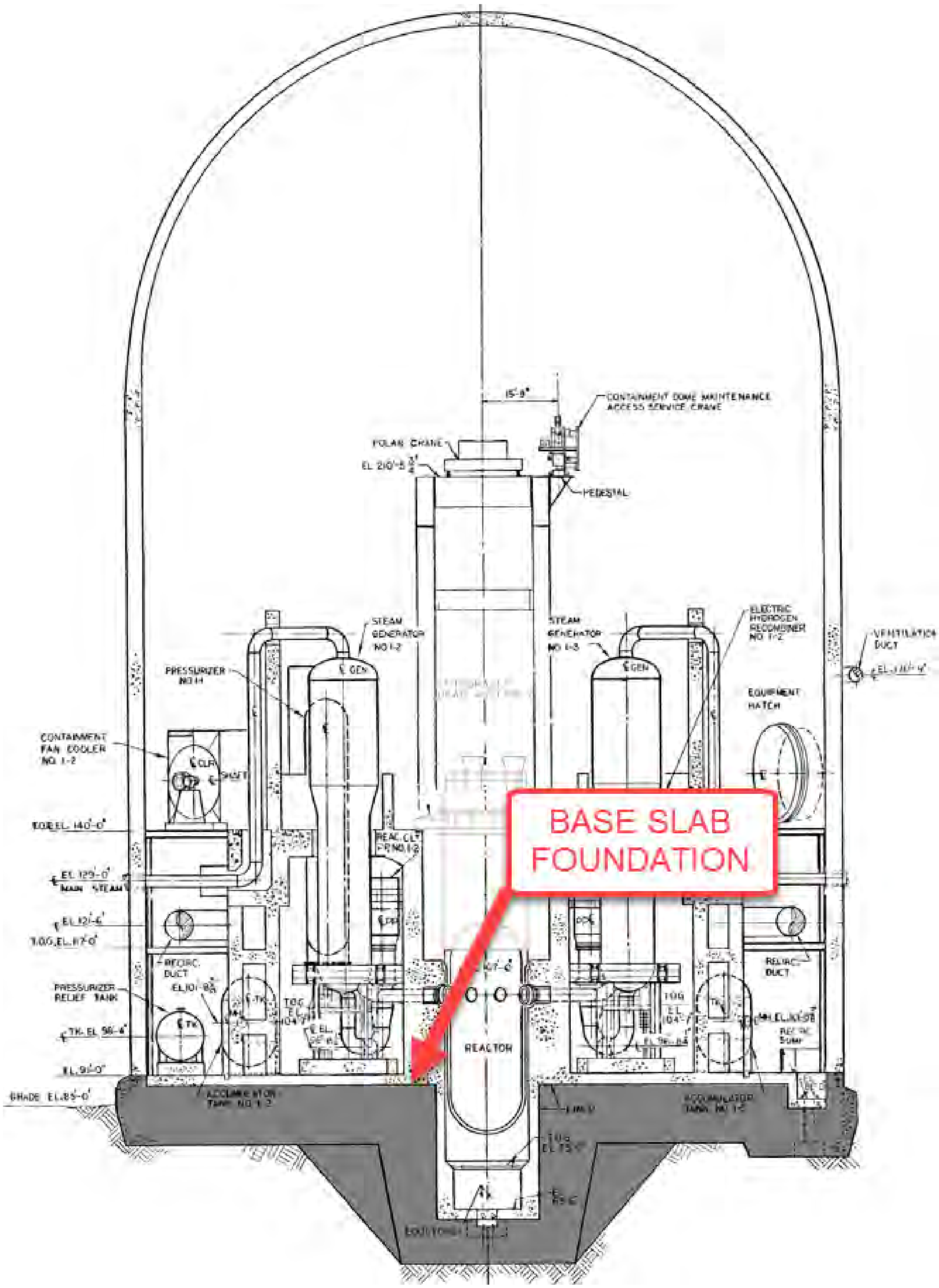


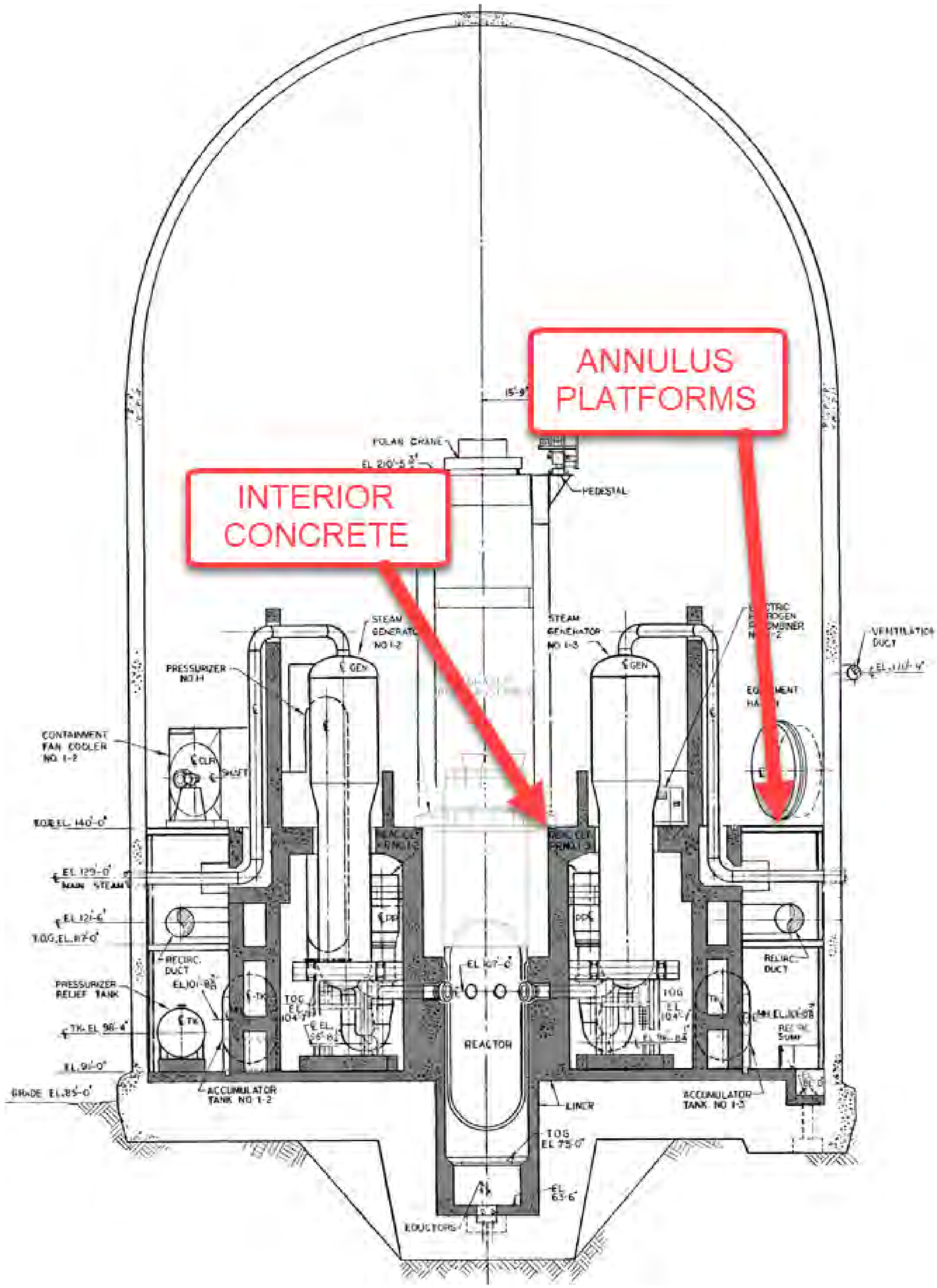
Figure 4-51: Containment Base Slab Foundation



The internal concrete structure is a 106-ft. diameter, 51-ft. high cylinder, with a slab on top and multiple openings and walls (e.g., the reactor shield wall, the stainless steel lined refueling canal, the crane wall, etc.). (Refer to Figure 4-52.) The walls and top slab are generally 3 ft. thick. This structure provides support for the reactor and components of the RCS, provides radiation shielding, and provides protection for the containment steel internal liner.

The containment internal structure also includes annulus platforms, which are structural steel platforms at elevations 117' and 140', located between the internal concrete structure and the exterior shell. Steel framing is also provided at approximate elevations 107' and 101' for support of piping.

Figure 4-52: Containment Interior Structures



A polar crane is mounted on top of the internal concrete cylinder wall. The containment polar crane (one for each unit) is an overhead gantry crane designed to travel along a circular rail located on top of the 3-ft. thick, 106-ft. outside diameter cylindrical crane wall. Each polar crane is a structural steel frame consisting of two main box girders, four gantry legs, two sill beams at the base of the gantry legs, and four tie beams connecting the main girders and gantry legs. The sill beams are each supported by two-wheel assemblies and are restrained by guide struts.

The piping and electrical connections between equipment inside the containment structure and other parts of the plant are made through specially designed, leak-tight penetrations. In addition to the piping and electrical penetrations, other penetrations are the 18-ft. 6-inch diameter equipment hatch, the 9-ft. 7-inch diameter personnel hatch, the 5-ft. 6-inch diameter personnel emergency hatch, and the fuel transfer tube.

The plant vent duct is attached to the outside of the structure, extending from an elevation of 25 ft. above the base slab to the top of the dome. The duct is fabricated from steel plate with stiffeners.

Photos from original construction of the containment structure are included in Figure 4-53 through Figure 4-56 to show the complexity of the excavations and construction associated with the installation of these structures.

Figure 4-53: Unit 1 Power Block Initial Excavation, June 1969

Figure 4-54: Unit 1 Containment, October 1969

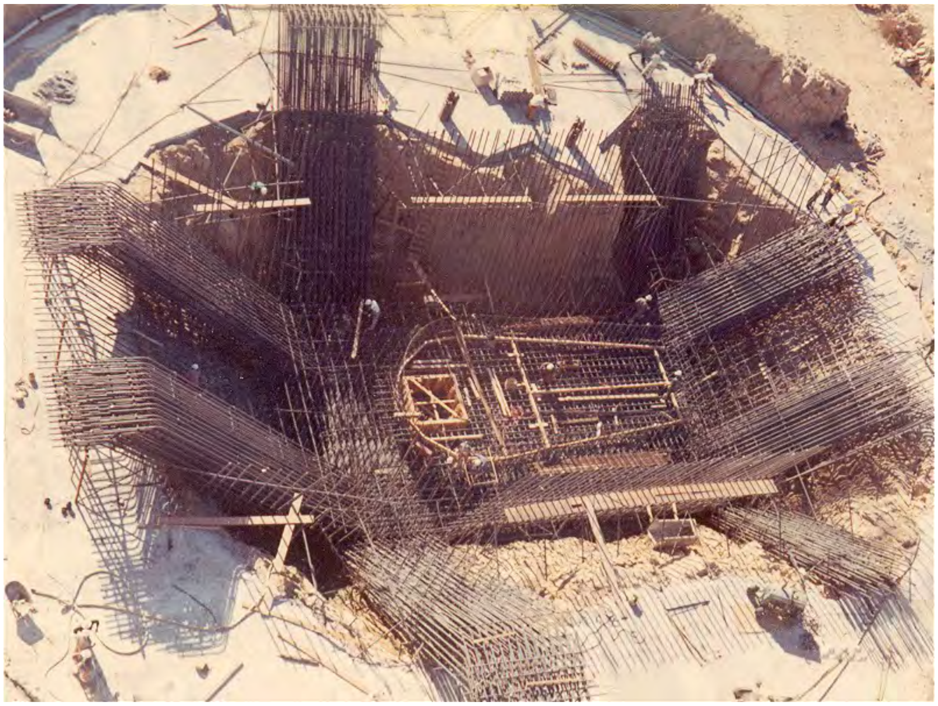


Figure4-55: Unit 1 Containment, June 1970

Figure 4-56: Unit 1 Containment, May 1971

The containment structure removal sequence will occur in the following major steps:

- Interior demolition (excluding crane wall)
- Polar crane demolition
- Liner plate decontamination
- Exterior concrete shell removal
- Base slab foundation removal

After the foundation is removed, the scope of work associated with building demolition will be completed, and the area will be turned over to the Final Site Restoration scope of work (see Section 4.1.3.1) for performance of final site surveys, backfill, and landscaping activities.

There are two main scheduling constraints to performing demolition of the containment structure exterior shell. First, in order to protect the spent nuclear fuel located in the nearby SFPs, demolition of the containment structure exterior shell will not start until all spent fuel and GTCC waste generated from reactor and reactor internals segmentation have been relocated to the ISFSI. Second, as discussed below, the method for demolishing the containment structure exterior shell cannot start until after demolition of the corresponding units' Auxiliary Building, Turbine Building, and Pipeway Structure, solely for access purposes.

Interior demolition may start earlier, since it is protected by the exterior shell; however, due to safety and security reasons, PG&E does not plan to initiate interior demolition until after the spent fuel and GTCC canisters have been moved to the ISFSI, at which point security controls can be relaxed around the current PA. Lessons learned at previous decommissioning projects involving Connecticut Yankee, SONGS's Units 1 and more recently at Zion Station have shown that the efficiency of demolition operations conducted within a security controlled PA is approximately 30 percent of the productivity of similar demolition operations carried out in an industrial area without these controls. The timing of containment demolition will therefore take advantage of these reduced cost impacts from the relaxed security controls. In addition, performing all containment structure interior demolition, including polar crane demolition, after all spent nuclear fuel and GTCC waste have been transferred to the ISFSI facility ensures that the integrity of the SFP will be maintained, and the spent fuel will be protected at all times.

Before interior concrete can be released for demolition, the following other scopes of work will be completed:

- All hazardous and regulated materials will be removed (see Section 4.1.1.3.2.1.)
- RPV and internals segmentation will be completed, and all waste materials and tooling will be removed from containment (see Section 4.1.1.4.)
- Large components: The SGs, pressurizer, RCPs and motors, reactor head with IHA, and manipulator cranes will be removed from containment (see Section 4.1.1.6.) The containment opening at the 140' level that was created to remove these components and the associated closure doors will still be in place.
- System and Area Closure: Systems containing radioactive materials above a certain threshold level will be removed from containment (see Section 4.1.1.6.)

The following activities will be performed to prepare the containment structures for demolition:

- A pre-demolition engineering report required by Standard Number 1926.850(a) of Chapter 29 of the Code of Federal Regulations, Subpart T, will be prepared.
- A fixative coating will be applied to all accessible remaining structural concrete and/or masonry surfaces and on the containment liner plate to prevent the spread of any loose contamination.
- If required by the work plans, a dust suppression system such as either a "water mister" or other similar technology and supporting HEPA filters will be installed, along with all required temporary power and water supplies.
- All remaining equipment, piping, components, etc., will be drained, purged, and air gapped.
- All floor openings on the operating deck at elevation 140' will be covered with steel plates to support required equipment loads and provide protection from falling debris to elevations below.
- A second containment opening will be provided at elevation 91'. A temporary ramp will be provided for access of materials and equipment to the local grade at elevation 85'.

- Characterization of the containment will be performed. The extent of activated concrete cannot be fully known until after removal of the reactor vessel. For purposes of the cost estimate, it is assumed that only the concrete of the bio-shield wall in the areas directly adjacent to reactor fuel elements is activated. This corresponds to the bio-shield wall between elevations 104' to 89'.

Some other systems and components not identified above will remain in the containment structure and will be demolished with the structure. The different waste components will be separated after demolition and transferred to a pre-determined location for packaging and disposal.

Interior Concrete Removal

A track-mounted backhoe (also called an excavator) with appropriately sized hydraulic hoe-ram and hydraulic shear attachments will be staged inside the containment buildings to demolish the interior concrete walls and slabs above the 140' elevation (e.g., the SG cubicles, pressurizer cubicle, etc.). Loaders will then move the demolition debris off the 140’ floor elevation, down one of the floor openings to the elevation 91’ floor below, and then out of the structure via the lower construction opening at ground level. All material will then be transferred to the radiologically contaminated material processing area for disposal.

The vertical reactor cavity walls will then be partially demolished from above by this same backhoe to a pre-determined level. The polar crane will lift the backhoe and position it on the floor of the reactor cavity, and the remainder of the cavity walls will be demolished to the cavity floor level at approximately elevation 114’. It is important to note that an engineering analysis will be performed as part of the work planning effort to maximize safety by verifying the stability of the structure from the equipment loads during this work activity.

The primary bio-shield wall (the structure surrounding the area that once held the reactor vessel) will be left intact and will be protected with steel plates while all other structural concrete is demolished above elevation 114’.

A pre-fabricated structural steel "debris catcher" will then be installed at the bottom of the bio-shield wall area at approximately 89' elevation. This device will collect the activated concrete of the bio-shield walls as they are demolished down to the 90' level. The debris catcher will be removed at frequent intervals using the polar crane, and the debris emptied and transferred to the radiologically contaminated material processing area for disposal.

After the bio-shield wall is demolished, the backhoe will demolish the remainder of the walls and slabs to elevation 91', with the exception of the polar crane support wall – the concrete cylinder wall that directly supports the polar crane rail. The backhoe will create an opening in the polar crane support wall that is large enough for it to pass through, and all debris will be removed via this opening and the lower containment openings and transferred to the radiologically contaminated material processing area for disposal.

Polar Crane and Annulus Steel Demolition

The containment building's polar crane will be parked in a pre-engineered location and taken out of service. After the interior concrete structure is demolished (excluding the crane wall), the trolley hoist and its bridge will be suspended from the top of the containment building by wire rope slings through several core holes drilled through the top of the containment building at predetermined locations.

Once the polar crane's trolley hoist and its bridge are secured to the top of the containment building, the two horizontal tie beams at the top of the gantry legs will be cut and removed. Two angular cuts will be made into a portion of each of the four polar crane's support legs. Small uncut portions of the support legs will remain to provide structural stability prior to removing the legs. The legs will then be removed by pulling them horizontally with a sling attached to the track-mounted backhoe or similar equipment located on the 91' floor slab sufficiently away from the fall path of the gantry leg. As each leg is removed, the slings attaching the polar crane trolley and bridge will go into tension and suspend the load from the top of the containment structure. When all four support legs have been removed, all personnel and equipment will be vacated from the interior of the containment building, and the wire slings will be cut from above the top of the containment building, allowing the polar crane to free-fall to the floor situated at elevation 91'. Prior to this work activity, a sacrificial layer of crushed limestone or similar screenings will be placed directly under the polar crane bridge structure on the 91' elevation to reduce the forces and vibrations caused by impact. All steel waste material will be further cut, downsized, and transferred to the radiologically contaminated material processing area for disposal.

This method of demolishing the polar crane was utilized at Maine Yankee in 2002; however, explosives were used on the vertical legs of the polar crane instead of thermal cuts. The use of explosives created an issue with over-pressurization of the containment structure, causing some minor damage to debris nets installed to prevent projectiles, as well as spreading some low-level contamination at the site. To prevent these issues from occurring at DCPP, the use of thermal cuts instead of explosives was chosen. Vibrations also were closely monitored at Maine Yankee due to their proximity to the SFP, which at that time contained spent fuel elements. No adverse impacts were noted from vibrations or other impact forces.

At DCPP, the polar crane support wall and annulus steel structure will be demolished from the top down, and the top portion of the foundation (approximately 2 ft. thick) will be removed to expose the embedded liner plate. All debris will be transferred to the radiologically contaminated material processing area for disposal through the lower construction opening.

Liner plate decontamination

The liner plate will be left in place after interior concrete demolition. The liner plate will be decontaminated to a bare bright status, which should render the liner plate a non-detectable material. Thus, the interior liner plate and each containment building's exterior will be capable of being demolished at the same time and can be disposed of as non-detectable demolition debris.

An abrasive grit blasting technology will be used to decontaminate the exposed liner plate. The abrasive blasting system uses aluminum oxide pellets that are readily available in a wide range of pellet sizes and pellet hardness factors. These pellets are expelled through wands via compressed air and are contained within a system that screens and captures any radiological contamination and recycles the pellets. Abrasive blasting technology has been effectively used at other decommissioning sites.

Exterior Concrete Shell Removal

The containment exterior concrete will be “walked down” (lowered vertically, one step at a time) from below by creating uniform openings on the containment building and by incrementally removing the intermediate sections between the openings.

This plan was developed in consultation with demolition experts, who considered previous experience with demolition of large concrete containments using techniques such as the following:

- Standard techniques such as the use of wrecking balls and or wrecking ingots
- Bringing the structure down using explosives
- A "walk-down" method where the entire structure is lowered vertically, one step at a time

The first technique, conventional “brute-force” demolition, was determined to be relatively time-consuming and cost prohibitive; it is an inefficient method for demolishing structures containing a large quantity of reinforcing steel like the DCPP containment structures.

The second technique – the use of explosives – would involve the following:

- Creating large openings in the structure in the form of archways, using a hydraulic hammer mounted on track-mounted backhoes. This also includes cutting away the liner in these locations.
- Attaching explosive charges to the “legs” left through the creation of the archways. Using a controlled explosion, the legs disintegrate and the upper part of the structure, essentially the hemispherical shaped dome falls
- Using backhoe mounted hoe-rams to rubblize the remainder of the structure.

As can be inferred from above, the use of explosives requires a great deal of hoe-ramming to first prepare the archways and then to rubblize the dome. Another negative aspect is the rather high cost of controlled explosive demolition from a preparatory cost perspective and the explosive demolition services themselves. Explosives were ultimately removed from the demolition options due to safety concerns and previous experience with this form of demolition at PG&E.

The third technique evaluated, and ultimately selected, was the "walk-down" method. This option has been successfully implemented at two other decommissioning sites: Connecticut Yankee and Trojan in Oregon.

The demolition of the containment exterior shell will be carried out by using track-mounted backhoes fitted with hoe-rams and shears. The sequence of operations is planned to be as follows:

- Remove an approximately 15 ft. tall strip of interior liner from the structure, starting at ground level.
- Remove the majority of a 5-ft. tall ring of concrete around each containment building, starting at ground level. Rubblize the concrete using a hoe-ram and cut the exposed reinforcing steel using a hydraulic shear. Three sections of the lowermost ring will be left intact; the width of each section will be determined by engineering calculations.
- Remove two of the remaining three sections using an armored track-mounted backhoe fitted with a hoe ram. Once sufficient material has been removed, the weakened section structurally will fail and fall the distance of 5 ft. As the building's overall height is reduced, the height of vertical removal sections may be adjusted based on the results of an engineering analysis.
- Reduce the size of waste material after each step, as necessary, and remove waste from the area.
- Repeat the process until all the cylindrical sections of the containment structure have been removed.

Once the dome section of the structure is lowered to grade level, the dome will be demolished in place as all of the remaining structure will be accessible by conventional backhoe-mounted equipment.

The containment exterior shell at Connecticut Yankee was demolished in the same way that’s being proposed at DCPP. The Connecticut Yankee containment structure was a pre-cast concrete cylinder and dome, very similar to DCPP's. In addition, this same method was used for containment exterior shell demolition at Trojan Nuclear Power Plant; however, that containment structure was of a different construction and involved the removal of post tensioned steel tendons as well. Many lessons learned from both of these experiences will be implemented into the DCPP removal operations. The photo contained in Figure 4-57 below illustrates this method at Trojan Nuclear Power Plant.

Figure 4-57: Trojan Nuclear Power Plant Containment Shell Demolition

Foundation Removal

As discussed above, a separate PG&E study provided recommendations on the extents of foundation removal. This study evaluated the Containment Structure foundation for partial removal to a depth of 3 ft. versus complete removal. The study recommended complete removal of the entire foundation.

Several factors were considered, including the potential for activated concrete underneath the reactor vessel, as well as the inability to perform complete radiological surveys of the features located underneath the slab. Complete removal was found the most viable option to address these issues.

The foundation of each Containment Building will be removed using similar backhoe-type equipment in a top-down approach. At a point in the demolition sequence, excavation of the perimeter soil to access the lower elevations will be required. The ground adjacent to these lower elevations will be sloped or benched in accordance with standard construction criteria (CalOSHA) to prevent excavation instability, and ramps will be excavated in strategic locations so that demolition and debris removal equipment (backhoes and dump trucks) can access this area. All debris will be transferred to the waste processing areas for disposal.

At this point, the building demolition scope of work for the containment structures will be completed.

Unit 1 and Unit 2 Pipeway Structures

The pipeway structure for each unit is a steel frame structure attached to the outside of the containment shell, the Auxiliary Building, and the Turbine Building. The pipeway structure in one unit is essentially a mirror image of the other. The primary function of the pipeway structure is to support main steam and feedwater piping. The pipeway structure has five major platforms located at elevations 109', 114', 118', 127', and 138'. Connections between the pipeway structure and the Auxiliary and Turbine Buildings are provided with slotted holes oriented so that horizontal motions cannot be transmitted between the structures.

To alleviate any potential safety concerns, pipeway demolition will not start until the nearby overhead 500kV power lines are taken out of service.

Each pipeway structure will be demolished on a column bay by column bay basis (e.g., demolish everything between column line A to column line B, column line B to column line C, etc.). This allows for structural stability as the demolition work progresses. Typical backhoes with steel shear attachments will be used for this demolition.

In keeping with efficient demolition work practices and good housekeeping objectives, the demolition debris will be moved away from the active demolition area in a safe and expeditious manner to reduce interferences. Once moved away from the active demolition area, the demolition debris will be segregated by materials (e.g., structural steel, pipe, general debris, etc.) to the greatest extent practicable and then loaded onto a transport vehicle and moved to the waste processing area for further dispositioning. Then the area will be turned over to the Final Site Restoration scope of work (see Section 4.1.3.1) for performance of final site survey, backfill, and landscaping activities.

Auxiliary Building (Bldg. 99)

The Auxiliary Building is located between and to the east of the Unit 1 and Unit 2 containment structures. It contains the control room and a Fuel Handling Building, which is considered part of the

Auxiliary Building. In addition, the Auxiliary Building contains equipment for the chemical volume control systems, safety injection systems, residual heat removal systems, component cooling water systems, the liquid radwaste systems, gaseous radwaste system, and others.

Photos from original construction of the Auxiliary Building are included in Figure 4-58 through Figure 4-60 to show the complexity of the excavations and construction associated with its installation. The original excavation is shown on the left side of Figure 4-53.

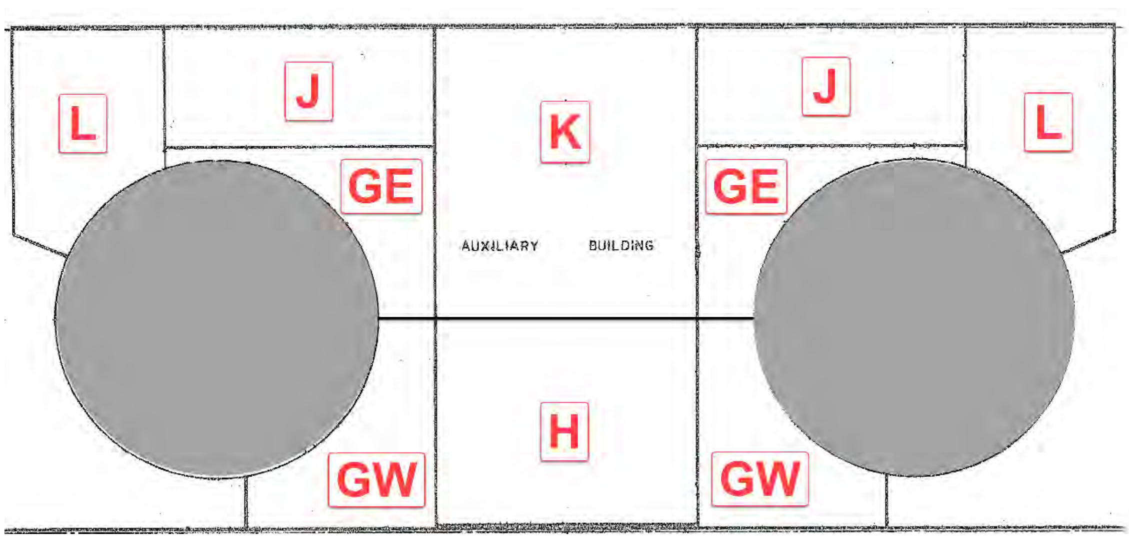
Figure 4-58: Auxiliary Building, January 1970

Figure 4-59: Auxiliary Building, March 1970

Figure 4-60: Auxiliary Building, May 1970

The Auxiliary Building is divided into various areas called areas H, K, GE, GW, J, and L. These areas are shown in Figure 4-61.

Figure 4-61: Auxiliary Building Area Designations



The main floor levels in the Auxiliary Building are at elevations 85', 100', 115', and 140'. Elevations 55', 60', and 73' are below ground level, which is at elevation 85', except for the east side of the building where ground level is at elevation 115'.

The foundation of the Auxiliary Building is divided between three elevations. The structure is supported at elevations 85' (Areas GE, GW, and L), 100' (Area J), and elevation 60' (Areas H and K).

Generally, one-half of the Auxiliary Building is a mirror image of the other, with each half of the structure containing equipment for one unit. The control room is in Area H at elevation 140'. The two fuel handling areas that contain the SFPs, the fuel handling cranes, fuel racks, and related equipment are in Area J on the east side of the Auxiliary Building with the top of the SFPs at elevation 140'.

The Auxiliary Building is a reinforced concrete shear wall structure, except for the fuel handling area crane support structure that is a structural steel moment resisting and braced frame structure supported on elevation 140' and extending up to elevation 188'. The shear walls and slabs of the Auxiliary Building are generally 2 ft. thick. The walls of the SFPs are 6 ft. thick except for local areas around the fuel transfer tubes. The foundation slabs under the SFPs have a minimum thickness of 5 ft. The SFP sides and bottoms are lined with stainless steel, 1/4-inch-thick on the bottoms and 1/8-inch nominal thickness on the sides.

The 125-ton overhead crane in the fuel handling area is equipped with restraints that prevent derailing from motions associated with an earthquake.

The only connections between the Auxiliary Building and other structures are the fuel transfer tube, miscellaneous piping, and attachments to the pipeway structure. The fuel transfer tube is fitted with expansion bellows that allow relative movement between the Auxiliary Building, the containment structures' exterior shell, and the internal structure of the containment structure.

The fuel handling area crane support structure is a 370 ft. by 60 ft. by 50-ft. high steel framed structure clad with metal siding and covered by metal decking and built-up roofing. The structure is supported on concrete walls at elevation 140' on the eastern side of the Auxiliary Building. The roof is a trussed and cross-braced diaphragm covered with metal decking.

In general, there is significantly more structural concrete in the Auxiliary Building than there is structural steel. Therefore, the demolition of the Auxiliary Building will mainly utilize concrete specialty demolition tools such as hoe-rams, concrete pulverizers, and concrete processors. Structural steel specialty demolition tools like hydraulic shears will be utilized to a much lesser degree.

The Auxiliary Building will be demolished after the following activities are completed:

- All hazardous and regulated materials will be removed (see Section 4.1.1.7.4.)
- System and Area Closure: Certain systems containing radioactive materials above a certain threshold level will be removed and disposed of separately (see Section 4.1.1.6.)

The following activities will be performed to prepare the Auxiliary Building for demolition:

- A pre-demolition engineering report required by Standard Number 1926.850(a) of Chapter 29 of the Code of Federal Regulations, Subpart T, will be prepared.
- A fixative coating will be applied to all accessible remaining structural concrete and/or masonry surfaces to prevent the spread of any loose contamination.

- If required by the work plans, a dust suppression system such as either a “water mister” or other similar technology and supporting HEPA filters will be installed, along with all required temporary power and water supplies.
- All remaining equipment, piping, components, etc., will be drained, purged, and air gapped.

The approach to demolishing the Auxiliary Building is rather straightforward in that the structure must be demolished incrementally as opposed to being demolished as a whole. Demolishing the structure as a whole is not feasible because the floors situated at elevation 85’ do not possess the requisite structural integrity to support the weight of the track-mounted backhoes that will be used to demolish the Auxiliary Building.

Multiple track-mounted backhoes fitted with the appropriate demolition tools and extended reach booms will be utilized to demolish the Auxiliary Building from its topmost elevation down to the floor situated at elevation 85’.

The resulting debris will be moved off the floor slab at elevation 85' and segregated by materials (e.g., structural steel, concrete rubble, general debris, etc.) to the greatest extent practicable and then be loaded onto a transport vehicle and moved to the waste processing area for further dispositioning.

At this juncture, the floor slab situated at elevation 85’ will be breached and the resulting demolition debris will remain inside the Auxiliary Building. The rubblizing of the floor and the structural concrete below the floor slab’s elevation will continue until a ramp can be constructed and shaped to enable the track-mounted backhoe to travel to the bottom of the Auxiliary Building at elevation 60’. Material will be moved out of the area to local grade elevation by wheel loaders using this ramp. It is highly likely that the breaching of the Auxiliary Building’s elevation 85’ floor slab and the ramping into the Auxiliary Building’s lower elevation will occur at multiple locations given the overall length of the building. One or more track --mounted backhoes will continue to demolish the Auxiliary Building while sitting on the elevation 60’ floor slab.

As the demolition progresses, larger systems or components will be cut into smaller sized pieces for handling, either by using a hydraulic shear attachment on the backhoe or by thermally cutting.

The end state of the walls and slabs below grade, determined by the separate PG&E study discussed above, will be as follows:

- Removal of internal walls and slabs below local grade to the top of the base slab (e.g., to the bottom-most foundation slab)
- Removal of the first 3’ of all exterior foundation walls to an elevation 3' below local grade
- Placement of fill over the remaining base slab and outside walls over the lower elevation of the building to elevation 85', sloping up the elevation 115' bench at the eastern edge of the building. Placement of fill at a gradual slope from 115' to 85' elevations will create a transition between these two elevations.

The demolition of the Auxiliary Building will continue until the only portions that remain are its perimeter walls and its lowermost floor slab. Once the Auxiliary Building achieves this end state condition, multiple backhoes will be fitted with excavating buckets and begin baling the ramp materials into transport vehicles to move the materials to the waste processing area for further processing and packaging for disposal.

At this point, demolition of the Auxiliary Building will be considered complete, and the area will be turned over to the Final Site Restoration scope of work (see Section 4.1.3.1) for performance of final site survey, backfill, and landscaping activities.

Outdoor Water Storage Tanks (Bldg. 100)

The outdoor water storage tanks, located adjacent to the east side of the Auxiliary Building, consist of seven tanks:

- Two Primary Water Storage Tanks, one per unit. These tanks are standard steel tanks, approximately 30 ft. in diameter and 40 ft. tall, and are used to contain clean, pure water for makeup to the reactor coolant system.
- Two Refueling Water Storage Tanks (RWSTs), one per unit. These are steel studded tanks with a concrete shielding exterior, approximately 42 ft. in diameter and 55 ft. tall. These tanks contain borated, slightly contaminated water that is mainly used for shielding purposes during refueling outages.
- Two Condensate Storage Tanks (CSTs), one per unit. These are steel studded tanks with a concrete shielding exterior, approximately 42 ft. in diameter and 50 ft. tall. These tanks contain clean makeup water for the secondary side systems.
- One firewater and transfer tank, which serves both Unit 1 and Unit 2, is made up of two concentric cylindrical steel tanks connected by a common dome roof. The inner cylindrical tank is the firewater tank and the outer tank is the transfer tank. Both the inner and outer tanks are standard steel tanks, and the outer tank is studded with a concrete shielding exterior. The outer tank is approximately 42 ft. in diameter and 52 ft. tall. Both tanks contain clean water dedicated for emergency firefighting response.

These tanks are set on top of standard concrete slab foundations, with grade beam footings around the perimeter. During seismic upgrades, the area below each RWST, the CST, and firewater and transfer tank foundation was excavated to the bedrock below, and the area filled with solid concrete. Rock-anchor hold down bolts that extend into the bedrock also were installed.

The outdoor water storage tanks will be demolished from the top down by standard demolition techniques, using track-mounted backhoes with concrete crushing and shear attachments. They will be fully drained and disconnected from any attached piping prior to demolition.

Fixative coatings will be applied as required by MARSSIM standards to any tanks that are radiologically contaminated to prevent the spread of contamination during demolition. The outdoor water storage tank foundations are not expected to contain radioactive materials; however, any contaminated foundation materials will be remediated as required. Foundations will be removed down to a depth of 3 ft. below local grade, and any remaining concrete fill that extends down to the deeper bedrock layers will be left in place. The area will then be turned over to the Final Site Restoration scope of work (see Section 4.1.3.1) for performance of final site survey, backfill, and landscaping activities.

Solid Radwaste Storage Facility and Radwaste Storage Building (Bldgs. 117A and 117B)

These buildings are located inside the RCA. The Solid Radwaste Storage Facility (SRSF) was built during the original plant construction and is now known as the northern radwaste storage building. A laundry facility was later added above the SRSF, and an elevator and the Radwaste Storage Building (RSB) were added to the south.

Solid Radwaste Storage Facility

The SRSF is separated into six bays, which are used to store radiation protection equipment and tools, and radioactive waste. The facility consists of one building containing these six storage areas or bays and a ventilation room. The SRSF also contains four chemical and gas storage vaults located north of the building, which were abandoned in place during plant operations. It also contains an elevator located at the south end.

The SRSF is constructed of concrete walls and slabs for structural stability and shielding. It has a slab on grade foundation, with perimeter and intermediate grade beams. The structure is built into the hillside, with its eastern walls directly against the soil acting as a retaining wall. The chemical and gas storage vaults are open in the front (along the west side). The laundry facility and elevator support structure that were added later are steel structures with sheet metal exterior siding and roof.

Radwaste Storage Building

The RSB is designed to store solidified or dewatered waste in either of two vaults. A railcar is provided to transport radwaste from the solidification pad area (east of the Auxiliary Building) into a truck bay. A bridge crane for transferring this radwaste is provided for each vault. A closed-circuit television system for inspecting and remotely operating two handling cranes is provided. A decontamination station and inspection area are included but never put into operation. This facility is also used for the transfer of radwaste liners from a railcar to trailer-mounted shipping casks for delivery to an off-site disposal facility. A separate Dry Active Waste (DAW) storage area is at the south end of the RSB and where DAW is transported by forklift in drums or boxes.

The RSB consists of a crane control room, a ventilation room, a truck bay, an inspection and decontamination station, two liner storage vaults and a DAW storage vault. The RSB is bounded on the north by the SRSF elevator.

The RSB is constructed of concrete walls and slabs for structural stability and shielding. It has a slab on grade foundation, with perimeter and intermediate grade beams. The structure is also built into the hillside, with its eastern walls directly against the soil acting as a retaining wall. The east wall of this structure is poured directly against bedrock and anchored in place with deep anchor bolts drilled and epoxied into the bedrock. Large openings on the front (west) concrete wall of the building are provided for moving radwaste materials and the railcar in and out of the facility. Concrete rolling shield walls are provided in front of these openings.

Ventilation systems serving the RSB and SRSF establish a negative pressure in these areas. Outside air supplies SRSF and RSB. The RSB and SRSF are provided with fans, roughing and HEPA filters used to filter and exhaust building air to the atmosphere. These features are needed to control and monitor the potential release pathways of radionuclides contained in the buildings.

Because both of these buildings are large, potentially contaminated structures, demolition is expected to occur during the same time as the other large, robust structures of the power block (e.g., the Auxiliary and Containment Structures). For this reason, demolition will not start until all nuclear spent fuel and GTCC waste have been relocated to the ISFSI.

The end state of the walls and slabs below grade, determined by the separate PG&E study discussed above, will be as follows:

- Complete removal of all below grade concrete walls and slabs of the Solid Radwaste Storage Facility (Bldg. 117A)
- Partial removal of the Radwaste Storage Building (Bldg. 117B):
  - ☐ Removal of all internal walls and slabs above local grade (elevation 115')
  - ☐ Removal of the base slab and all foundation grade beams
  - ☐ Abandonment of the back rock-bolted eastern-most walls

The approach to demolishing the SRSF and RSB is very similar to that of the Auxiliary Building; it is rather straightforward in that the structures will be demolished incrementally as opposed to being demolished as a whole. Multiple track-mounted backhoes fitted with the appropriate demolition tools and extended reach booms will be used to demolish the buildings from their topmost elevation down to local grade situated at elevation 115’.

The resulting debris will be moved off the floor slab at elevation 115' and segregated by materials (e.g., structural steel, concrete rubble, general debris, etc.) to the greatest extent practicable, then be loaded onto a transport vehicle and moved to the waste processing area for further dispositioning. The floor slabs will then be demolished, and the debris dispositioned in a similar fashion. The area will then be turned over to the Final Site Restoration scope of work (see Section 4.1.3.1) for performance of final site survey, backfill, and landscaping activities.

RCA Storage Building (Bldg. 117C)

This building is located inside the RCA and is used to store miscellaneous contaminated tools and materials required inside the RCA. It is a standard pre-fabricated steel structure with sheet metal siding and roof and is built on a concrete slab on grade foundation with perimeter grade beams.

This structure will be demolished on a column bay by column bay basis (e.g., demolish everything between column line A to column line B, column line B to column line C, etc.). This will allow for structural stability as the demolition work progresses. Typical backhoes with steel shear attachments will be used for demolishing the above grade structure. This building will be demolished during the same time as the other buildings inside the RCA as previously discussed.

As discussed above, a separate PG&E study recommended complete removal of the entire foundation. The depth of the entire foundation is less than 3 ft., so removal will be performed utilizing similar backhoe type equipment with hoe ram and concrete shear attachments. All debris will be transferred to the waste processing areas for disposal, and the area will be turned over to the Final Site Restoration scope of work (see Section 4.1.3.1) for performance of final site survey, backfill, and landscaping activities.

RCA Calibration Facility (Bldg. 131)

This building is located inside the RCA and is a 500 square ft. permanently mounted modular facility.

Demolition of this building includes completely removing the structure and related equipment within the RCA to ground level at elevation 115', using conventional demolition methods and standard demolition excavators with a bucket/thumb or metal cutting shear, loaders, and off-road trucks. Demolition debris will be transferred to a pre-determined location for packaging and disposal, and the area will be turned over to the Final Site Restoration scope of work (see Section 4.1.3.1) for performance of final site survey, backfill, and landscaping activities.

This building will be demolished during the same time as the other buildings inside the RCA, as previously discussed.

Turbine Building (Bldg. 101)

This building is located outside the RCA, adjacent to the west side of the Auxiliary Building, as shown in DCPP Final Safety Analysis Report Figure 1.2-2, Plant Layout. The Turbine Building is approximately 750 ft. long, approximately 140 ft. wide and approximately 130 ft. tall. The lowermost portion of its foundation is located at elevation 45’, which is approximately 40 ft. below adjacent grade at 85' elevation. The Turbine Building is a reinforced concrete shear wall structure except for the superstructure, which is a structural steel moment resisting and braced frame structure extending from elevation 140' to elevation 217'. Shear walls generally range from 16 to 29 inches thick. Floors are 10- to 12-inch-thick reinforced concrete slabs or 1/2-inch-thick steel plate, supported on steel framing and steel columns. The reinforced concrete foundation mat is generally 3 ft. thick except under the turbine pedestal, where the thickness is 10 ft. Reinforced concrete turbine pedestals, one for each unit, are in the building; six piers of each pedestal are post-tensioned. The pedestals are structurally isolated from the building floors and extend from the common foundation slab, elevation 85', to elevation 140'. Two 135-ton overhead cranes are in the building.

Generally, the Unit 1 and Unit 2 portions of the Turbine Building are opposite hand and similar to the other, with each portion containing equipment for one unit. Exceptions are the presence of a machine shop and material storage area common to both units in the Unit 1 portion, and the on-site TSC in the Unit 2 portion of the west buttress structure. During seismic retrofits prior to initial operation, the building was re-evaluated and upgraded to withstand higher seismic loads. Buttresses and concrete walls were added to the Turbine Building, and internal modifications, such as reinforcing main columns, strengthening floor diaphragms, and additional roof and wall bracing, were made. At this time, the turbine pedestal also was re-evaluated and upgraded. Six of the twelve piers were post-tensioned, and the pedestal-to-building separations were increased along the east and west sides of the pedestal.

Main floor levels in the Turbine Building are at elevations 85', 104', 119', and 140'. The foundation of the building is at elevation 85'; however, lower floor levels are also provided in the building to support main equipment. In addition, the circulating water tunnels enter the west side of the Turbine Building foundation and terminate vertically below the main condenser in the center of each unit's structure.

Photos from the original construction of the Turbine Building are included in Figure 4-62 through Figure 4-65 to show the complexity of the excavations and construction. The original excavation is shown in the upper portion of Figure 4-53, which also shows the excavations for the Intake and Discharge Tunnels.

Figure 4-62: Unit 1 Turbine Building, December 1969

Figure 4-63: Unit 1 Turbine Building, February 1970

Figure 4-64: Unit 1 Turbine Building, November 1970

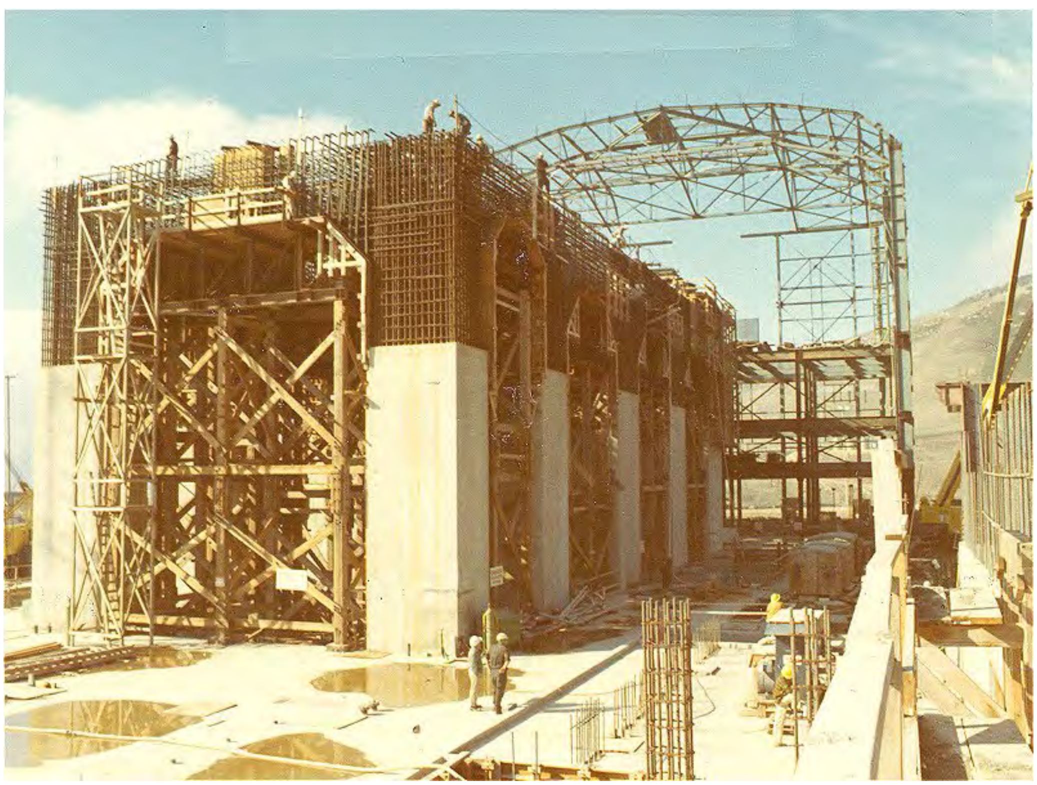


Figure 4-65: Unit 1 Turbine Building, April 1971

The Turbine Building removal sequence will occur in the following major steps:

- Overhead crane removal and demolition
- Demolition of steel superstructure above 140' elevation
- Demolition of main Turbine Building
- Partial foundation removal

The main schedule constraint to begin demolishing the Turbine Building is the need to maintain operation of the CAS facility that is in the Turbine Building. CAS is required to maintain the operation of the security system around the PA. Because the security system must be operational until all spent fuel and GTCC waste have been relocated to the ISFSI, the Turbine Building will not be demolished until that occurs. PG&E evaluated the possibility of relocating the CAS facility so that the Turbine Building could be demolished sooner but eliminated that option due to its excessive costs.

Demolition of the Turbine Building will start after the following activities are completed:

- All hazardous and regulated materials will be removed, including the “Galbestos” exterior siding (see Section 4.1.1.3.1.)
- Large components: The low and high-pressure turbine rotors, main condensers, moisture separators/reheaters, and #2 feedwater heaters will be removed from the Turbine Building structure (see Section 4.1.1.4.)
- System and Area Closure: Certain systems containing radioactive materials above a certain threshold level will be removed from the Turbine Building (see Section 4.1.1.6.)

The following activities will be performed to prepare the Turbine Building for demolition:

- A pre-demolition engineering report required by Standard Number 1926.850(a) of Chapter 29 of the Code of Federal Regulations, Subpart T, will be prepared.
- A fixative coating will be applied to all accessible remaining structural concrete and/or masonry surfaces, if required, to prevent the spread of any loose contamination.
- If required by the work plans, a dust suppression system such as either a "water mister" or other similar technology and supporting HEPA filters will be installed, along with all required temporary power and water supplies.
- All remaining equipment, piping, components, etc., will be drained, purged, and air gapped.

All other systems and components not identified above will remain in the Turbine Building and will be demolished with the structure. The different waste components will be separated after demolition and transferred to a pre-determined location for packaging and disposal.

Overhead crane removal and demolition

Provisions will be made to extend the overhead crane rails in the Turbine Building so that the overhead cranes can be "parked" immediately adjacent to the building's north wall.

In advance of parking each overhead crane at the north end of the Turbine Building, the following operations will be performed:

1.) The trolley hoist portion of the overhead crane will be securely lashed down and secured to the overhead crane's bridge girders.
2.) Structural steel will be installed to temporarily extend the overhead crane rails to the north end of the Turbine Building
3.) The siding at the north end of the Turbine Building will be removed from the roofline of the Turbine Building to the bottommost elevation of the extended crane rails.
4.) Any building structural components at the north end of the Turbine Building such as cross-bracing, channels used to affix the siding to the building, portions of columns, or any other components or piping, will be removed to preclude any interferences.

A cable will then be affixed to the midpoint of the overhead crane's northerly bridge girder while the other end of the cable will be affixed to the undercarriage of a track-mounted backhoe situated well to the north of the Turbine Building. The backhoe, while backing away from the Turbine Building, will apply tension to the cable and pull the overhead crane out of the building.

Once on the ground, the overhead crane will be size reduced, loaded onto a transport vehicle and moved to the waste processing area for further dispositioning. The second overhead crane will be removed, size reduced, and transported to the waste processing area for disposal in the same manner.

Demolition of steel superstructure above 140' elevation

Following the completion of the cleanup operations of the overhead cranes, removal of the portion of the Turbine Building situated above elevation 140’ will begin.

In essence, the portion of the Turbine Building’s structure that is situated above elevation 140’ will be “pulled over.” The notion and practice of either pulling a structure over, or pulling a portion of a structure over, is a common demolition methodology in the heavy industrial demolition industry that was developed in the mid-1980s when numerous steel mills owned by National Steel, LTV Steel and U.S. Steel were being demolished in their entirety.

Given the overall length of the Turbine Building, the demolition team will most likely elect to make five separate and distinct pulls of approximately 150’ in length. Splitting the Turbine Building into five pulls avoids getting too much demolition debris too soon, which would make the cleanup operation somewhat problematic.

To maximize efficiency, two pulls will most likely be made back-to-back. Presuming that the pulls are numbered one through five on a north-south basis, one would make pulls 1 and 5 in rapid order, cleanup the debris generated by those two pulls; then make pulls 2 and 4 in rapid order and cleanup the debris generated by those two pulls; and conclude with making pull 3 and cleaning up the debris generated by it.

NOTE: The discussion below is based on work instruction that will be prepared, in part, by a structural engineer who will make the determination of thermal cut locations so that after the thermal cuts have been made on the structure; the structure remains structurally sound.

Each pull is accomplished by preparing the structural steel columns along the east and west sides of the structure within a given pull section by partially cutting the flanges in strategic, pre-determined locations and sizes. Additionally, bottom chords of the roof trusses in these sections will be cut in multiple locations to allow for their failure in a pre-determined manner. When the columns within the pull zone have been prepared and the bottom chords of the roof trusses have been severed at the appropriate locations, a cable will be affixed to the center-most column of the bay, while the other end of the cable will be affixed to the undercarriage of a track-mounted backhoe situated well to the west of the Turbine Building. The backhoe, while backing away from the Turbine Building, will apply tension to the cable and ultimately pull the prepared section over.

The resulting demolition debris will then be moved to the ground via demolition grapples that have been affixed to long dipper stick extensions on multiple backhoes. Once on the ground, the debris will be size reduced, loaded onto a transport vehicle and moved to the waste processing area for further dispositioning.

The process is repeated until the entire Turbine Building above elevation 140’ has been removed and the resulting demolition debris has either been disposed of off-site or been moved to the waste processing area for further downsizing, processing, and packaging for disposal.

After the portion of the Turbine Building above elevation 140’ has been removed, the remaining Turbine Building demolition project will become a routine heavy industrial demolition project. The building’s demolition will advance from west to east on a column bay by column bay basis (e.g., demolish everything between column line A to column line B, column line B to column line C, etc.).

As the demolition progresses, larger systems or components will be cut into smaller sized pieces for handling, either by using a hydraulic shear attachment on the backhoe or by thermally cutting.

In keeping with efficient demolition work practices and good housekeeping objectives; the demolition debris will be moved away from the active demolition area in a safe and expeditious manner so that it does not interfere with ongoing demolition operations.

Once removed away from the active demolition area, the demolition debris will be segregated by materials (e.g., structural steel, concrete rubble, general debris, etc.) to the greatest extent practicable and then be loaded onto a transport vehicle and moved to the waste processing area for further dispositioning.

The concrete turbine pedestals will remain in place until the entire Turbine Building has been demolished and the debris has either been moved to the waste processing area for further downsizing, processing, and packaging for disposal or located a sufficient distance away from the pedestals so that it does not become comingled with the concrete rubble generated by the demolition of the turbine pedestals.

Multiple track-mounted backhoes fitted with the appropriate demolition tools and extended reach booms will be utilized to demolish the turbine pedestals from their topmost elevation down to the floor situated at elevation 85’. The intent is to repurpose the concrete rubble generated by the demolition of the turbine pedestals by crushing the concrete rubble and manufacturing concrete aggregate to be used as backfill during the final site restoration phase of the DCPP’s decommissioning project.

The end state of the walls and slabs below grade, determined by the separate PG&E study discussed above, will be as follows:

- Removal of internal walls and slabs below local grade to the top of the base slab (e.g., to the bottom-most foundation slab)
- Removal of the first 3’ of all exterior foundation walls to an elevation 3' below local grade
- Placement of fill over the remaining base slab and outside walls over the lower elevation of the building to local grade at elevation 85'

The remainder of the Turbine Building lower elevations and foundation below elevation 85' will be demolished very similar to the method described for the Auxiliary Building. The demolition of the Turbine Building will continue until the only items that remain are its perimeter walls and its lowermost floor slab. The area will then be turned over to the Final Site Restoration scope of work (see Section 4.1.3.1) for performance of final site survey, backfill, and landscaping activities.

Other below grade tanks in Zone 1

- Units 1 and 2 Transformer Yard Oil Retention Basins (Bldgs. D-18 and D-19)
- Abandoned Diesel Storage Tanks (Bldg. D-14)

The transformer yard oil retention basins are rectangular shaped, below grade holding ponds designed to capture all water and other liquids from the main bank transformer yard areas, including the potential of oil if the transformer ruptures. They are approximately 54 ft. long, 16 ft. wide and 8 ft. deep. There is one basin in each unit's outside yard area, just outside the main bank transformer yard area. The proposed demolition method for these basins is to remove the soil above them and a portion of the concrete top slab to provide access. This access hole would then be used to clean the potentially hazardous materials from inside the basins and fill them with either flowable grout or other suitable backfill material and abandon them in place. It is important to note that there was a low level radioactive spill in the RCA east of the Auxiliary Building that eventually found its way to the Unit 1 oil retention basin, so it is expected that a small amount of radioactive decontamination may be required in this basin. This does not apply to the Unit 2 basin.

There are two below grade abandoned diesel storage tanks, one 12,000-gallon and one 25,000-gallon capacity. These tanks are cylindrical steel constructions and are located roughly 5 ft. below local grade in the yard area north of the Unit 1 containment structure. Closure certification was completed with the San Luis Obispo County in the 1990s, and these tanks are no longer considered an environmental hazard and will be fully removed.

The demolition and removal of these items will be performed by a standard industrial demolition team, using standard demolition techniques including, but not limited to, the following types of equipment:

- Track- or wheel-mounted backhoes
- Hydraulic hoe-rams
- Hydraulic shears
- Concrete pulverizers
- Universal processors
- Articulated wheel load grapples, track-mounted backhoe grapples, and track-mounted backhoe "thumbs"
- On-site trucks

In keeping with efficient demolition work practices and good housekeeping objectives, the demolition debris will be moved away from the active demolition area in a safe and expeditious manner to reduce

interferences. Once removed away from the active demolition area, the demolition debris will be segregated by materials (i.e., structural steel, concrete rubble, general debris, etc.) to the greatest extent practicable and then loaded onto a transport vehicle and moved to the waste processing area for further dispositioning. The area will then be turned over to the Final Site Restoration scope of work (see Section 4.1.3.1) for performance of final site survey, backfill, and landscaping activities.

Other Zone 1 buildings:

- Service Air Building. (Bldg. 90)
- I&C/Medical Facility (Bldg. 102)
- Aux Boiler Enclosure (Bldg. 118)
- Craft Facility - Storage (Assembly Building) (Bldg. 518)
- Warehouse A (Bldg. 519)
- Paint Department Facility (Bldg. 520)
- Offices (Bldg. 521)
- Start-up - I&C Craft Shop (Bldg. 527)
- Toilet trailer (Bldg. 528)
- Scaffold Storage Area (Hazardous Waste Handling Area) (Bldg. 531)

The following activities will be performed to prepare the Zone 1 structures for demolition:

- A pre-demolition engineering report required by Standard Number 1926.850(a) of Chapter 29 of the Code of Federal Regulations, Subpart T, will be prepared.
- All known hazardous and/or regulated materials will be removed from the structures.
- All system equipment, piping, components, electrical switchgear, etc., designated for removal will be removed from the interior confines of the structures.
- All remaining equipment, piping, components, etc., have been drained, purged, and air gapped.
- The structures will be in a “cold-and-dark” condition prior to the onset of demolition activities.
- Radiation protection personnel will survey and release the structure for demolition to Open Air Demolition criteria.
- If required by the work plans, a dust suppression system such as either a “water mister” or other similar technology and supporting HEPA filters will be installed, along with all required temporary power and water supplies.

The following structures will be demolished early in the project (as soon as possible) to support the Security Plan (see Section 3.4):

- I&C/Medical Facility (Bldg. 102)
- Craft Facility - Storage (Assembly Building) (Bldg. 518)
- Warehouse A (Bldg. 519)
- Paint Department Facility (Bldg. 520)
- Offices (Bldg. 521)

- Start-up - I&C Craft Shop (Bldg. 527)
- Toilet trailer (Bldg. 528)

Other Zone 1 structures will be removed in accordance with the project schedule.

The demolition and removal of these other Zone 1 structures can be performed by a standard industrial demolition team, using standard demolition techniques including, but not limited to, the following types of equipment:

- Hydraulic hoe-rams
- Hydraulic shears
- Concrete pulverizers
- Universal processors
- Articulated wheel load grapples, track-mounted backhoe grapples, and track-mounted backhoe "thumbs"
- On-site trucks

For larger structures such as the I&C Medical Facility, the demolition will advance from the top down on a column bay by column bay basis (e.g., demolish everything between column line A to column line B, column line B to column line C, etc.).

The end state of the walls and slabs below grade, determined by the separate PG&E study discussed above will be as follows:

- Removal of internal walls and slabs below local grade to the top of the base slab (i.e., to the bottom-most foundation slab)
- Removal of the first 3' of all exterior foundation walls to an elevation 3' below local grade
- Placement of fill over the remaining base slab and outside walls over the lower elevation of the building to local grade

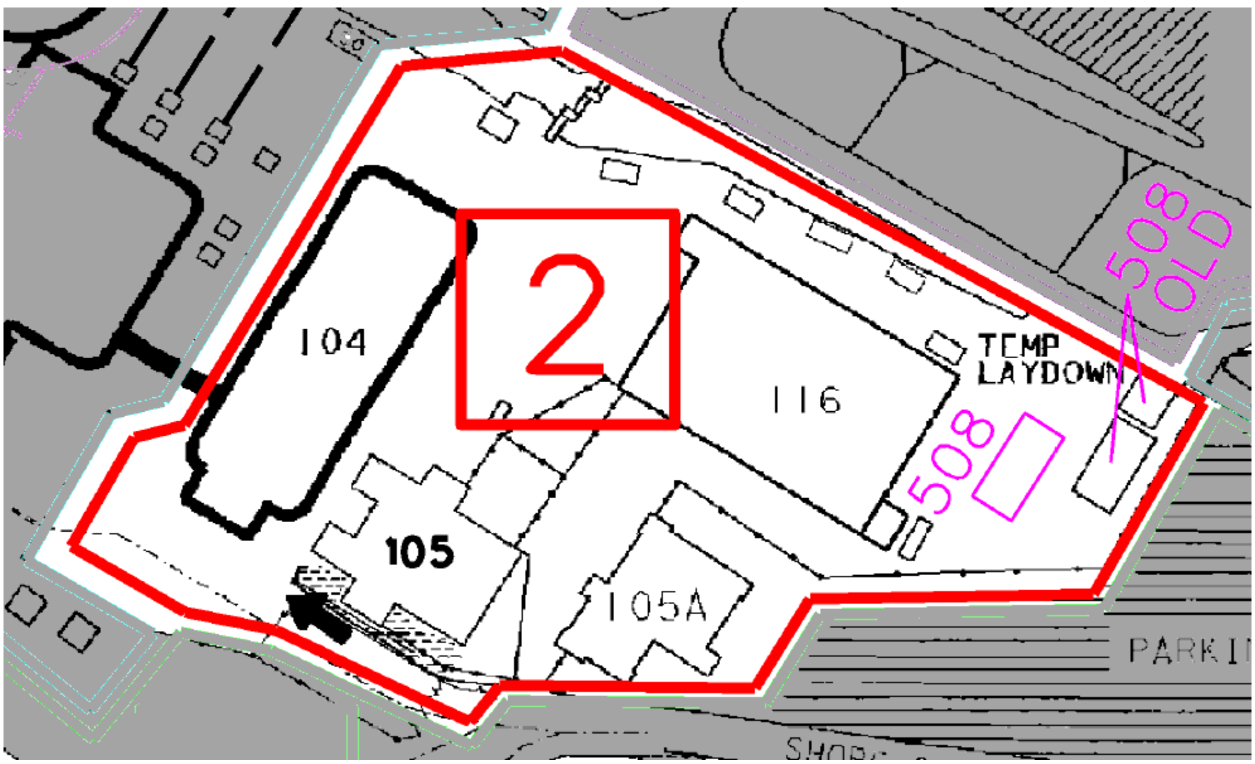
Note that for the majority of the remaining Zone 1 structures, the depth of the entire foundation is less than 3 ft.; therefore, full foundation removal will be performed for those structures. The ground adjacent to the foundations that require removal will be sloped or benched in accordance with standard construction criteria (CalOSHA) to prevent excavation instability, and ramps will be excavated in strategic locations so that demolition and debris removal equipment (backhoes and dump trucks) will be able to access the area as needed.

In keeping with efficient demolition work practices and good housekeeping objectives, the demolition debris will be moved away from the active demolition area in a safe and expeditious manner to reduce interferences. Once removed away from the active demolition area, the demolition debris is to be segregated by materials (i.e., structural steel, concrete rubble, general debris, etc.) to the greatest extent practicable and then loaded onto a transport vehicle and moved to the waste processing area for further dispositioning. The area will then be turned over to the Final Site Restoration scope of work (see Section 4.1.3.1) for performance of final site survey, backfill, and landscaping activities.

4.1.3.2.2. Building Demolition Zone 2

Zone 2 consists of an area that encompasses the PA structures south of the main power block at elevation 85'. None of the structures in Zone 2 are inside the RCA. See Figure 4-66 for the relative locations of the plant buildings within Zone 2.

Figure 4-66: Zone 2 Buildings



The following is a detailed list and description of permanent plant structures and facilities within Zone 2 to be demolished:

- Administration Building (Bldg. 104) – Serves as the main office building to support DCPP operations and includes the onsite cafeteria and large plant assembly area. The building is 252 ft. long by 95 ft. wide by 110 ft. tall and consists of steel construction on a slab with perimeter and column footings. Besides the footings, the only below-grade portions are associated with the building's elevator shaft. There are no contaminated areas or hazardous materials stored in this building.
- Security Office Building (Bldg. 105) – Serves as the main conduit for allowing access into the Main Protected Area. This building is 107 ft. by 105 ft. by 20 ft. tall and consists of concrete

construction on a slab with perimeter and column footings. There are no contaminated areas or hazardous materials stored in this building.

- Protected Area Access Facility (Bldg. 105A) – Serves as the main offices for the DCPP Security Department. This building is 92 ft. by 91 ft. by 28 ft. tall and consists of concrete construction on a slab with perimeter and column footings. There are no contaminated areas or hazardous materials stored in this building.
- Unit 2 Cold Machine Shop (Bldg. 116) – Serves as a main workshop area outside of the RCA. This building is 203 ft. by 133 ft. by 44 ft. tall and consists of steel construction on a slab with perimeter and column footings. There are no contaminated areas or hazardous materials stored in this building.
- Office Trailers (508 and 508-old) – Serve as auxiliary office space to support DCPP projects. These trailers are 20 ft. by 40 ft. by 12 ft. tall each and consist of modular construction. There are no contaminated areas or hazardous materials stored in these trailers.

The Zone 2 buildings are standard concrete, steel, or modular buildings built on slabs with minimal footings (perimeter and column). The internal structure environments are either typical office buildings or workshops and do not contain hazardous materials. Because these buildings are not unique in how they were built or what they contain, they are not classified as heavy industrial demolition projects. Building demolition scope for these facilities consists of complete demolition and removal of all structures above grade, and removal of all or some foundations. A study performed by PG&E to evaluate the extent of foundation removal for each structure recommends the following:

- Administration Building (Bldg. 104) – 3' below grade
- Security Office Building (Bldg. 105) – 3' below grade
- Protected Area Access Facility (Bldg. 105A) – full removal of all foundations
- Unit 2 Cold Machine Shop (Bldg. 116) – 3' below grade
- Office Trailers (508 and 508-old) – full removal of all foundations

Schedule

The following activities will be performed to prepare the Zone 2 structures for demolition:

- A pre-demolition engineering report required by Standard Number 1926.850(a) of Chapter 29 of the Code of Federal Regulations, Subpart T, will be prepared.
- All known hazardous and/or regulated materials will be removed from the structures.
- All system equipment, piping, components, electrical switchgear, etc., designated for removal will be removed from the interior confines of the structures.
- All remaining equipment, piping, components, etc., will be drained, purged, and air gapped.
- The structures will be in a "cold-and-dark" condition prior to the onset of demolition activities.
- Radiation protection personnel will survey and release the structure for demolition to Open Air Demolition criteria.

- If required by the work plans, a dust suppression system such as either a "water mister" or other similar technology and supporting HEPA filters will be installed, along with all required temporary power and water supplies.

Removal of the above grade structure of the Administration Building is scheduled to occur early in the decommissioning project to provide staging area for remaining on-site activities. After its removal, the Site Infrastructure plan will utilize the existing concrete foundation as a base for a fabric covered structure (see Section 4.1.1.2.2 for details). The foundation will remain in place until after all other Zone 1 and 2 structures are removed at the end of the project.

Similarly, the Unit 2 Cold Machine Shop will be utilized by the Site Infrastructure Plan as a repair facility for shipping canisters during the demolition of all structures on site. In order to support this function as long as possible, this facility will be demolished at the end of the building demolition schedule.

Both the Security Office Building and the Protected Area Access Facility contain equipment that is required to support the security plan and will be demolished after the spent fuel and GTCC waste have been relocated to the ISFSI and the main PA is eliminated.

The office trailers have no specific requirements or project uses and will be removed in accordance with the project schedule. Their removal has been scheduled to minimize mobilization and demobilization costs of a demolition contractor, as well as levelized waste streams and disposal costs.

Methodologies and Techniques

The demolition and removal of all Zone 2 structures can be performed by a standard industrial demolition team, using standard demolition techniques including, but not limited to, the following types of equipment:

- Hydraulic hoe-rams
- Hydraulic shears
- Concrete pulverizers
- Universal processors
- Articulated wheel load grapples, track-mounted backhoe grapples, and track-mounted backhoe "thumbs"
- On-site trucks

For larger structures such as the Administration Building, the demolition will advance from the top down on a column bay by column bay basis (e.g., demolish everything between column line A to column line B, column line B to column line C, etc.).

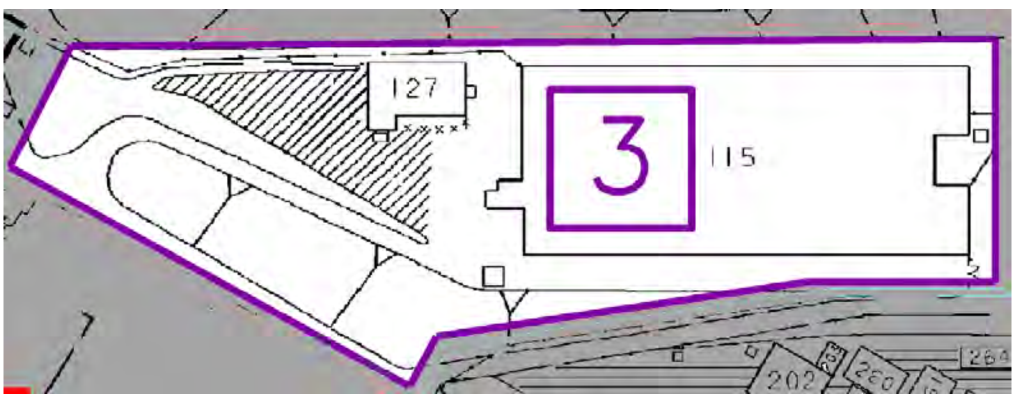
The ground adjacent to the foundations that require removal will be sloped or benched in accordance with standard construction criteria (CalOSHA) to prevent excavation instability, and ramps will be excavated in strategic locations so that demolition and debris removal equipment (backhoes and dump trucks) will be able to access the area as needed.

In keeping with efficient demolition work practices and good housekeeping objectives, the demolition debris will be moved away from the active demolition area in a safe and expeditious manner to reduce interferences. Once removed away from the active demolition area, the demolition debris will be segregated by materials (i.e., structural steel, concrete rubble, general debris, etc.) to the greatest extent practicable and then loaded onto a transport vehicle and moved to the waste processing area for further dispositioning. The area will then be turned over to the Final Site Restoration scope of work (see Section 4.1.3.1) for performance of final site survey, backfill, and landscaping activities.

4.1.3.2.3. Building Demolition Zone 3

Zone 3 consists of an area that encompasses the structures located in the south east portion of the PA at elevation 140'. None of the structures in Zone 3 are inside the RCA. (See Figure 4-67 for relative locations of the plant buildings within Zone 3.)

Figure 4-67: Zone 3 Buildings



The following is a detailed list and description of permanent plant structures and facilities within Zone 3 to be demolished:

- Main Warehouse (Bldg. 115) – Serves as a main storage warehouse for the DCPP site and includes additional office space for the DCPP Engineering Department. This building is 479 ft. by 211 ft. by 105 ft. tall and consists of steel construction on a slab with perimeter and column footings. There are no contaminated areas stored in this building.
- Liquids Storage Facility (Bldg. 127) – Serves as a storage facility for the majority of liquids onsite outside of the RCA. This is a metal building that is 103 ft. by 50 ft. by 29 ft. tall on a slab with perimeter and column footings. There are no contaminated areas, but hazardous liquid materials are stored in this building.

The Zone 3 buildings are metal buildings built on slabs with minimal footings (perimeter and column). The internal structure environments are typical of a warehouse. Because these buildings are not unique in how they were built or what they contain, they are not classified as heavy industrial demolition projects. Building demolition scope for these facilities consists of complete demolition and removal of all structures above grade, and removal of all foundations.

Schedule

The following activities will be performed to prepare the Zone 3 structures for demolition:

- A pre-demolition engineering report required by Standard Number 1926.850(a) of Chapter 29 of the Code of Federal Regulations, Subpart T, will be prepared.
- All known hazardous and/or regulated materials will be removed from the structures.
- All system equipment, piping, components, electrical switchgear, etc., designated for removal will be removed from the interior confines of the structures.
- All remaining equipment, piping, components, etc., will be drained, purged, and air gapped.
- The structures will be in a “cold-and-dark” condition prior to the onset of demolition activities.
- Radiation protection personnel will survey and release the structure for demolition to Open Air Demolition criteria.
- If required by the work plans, a dust suppression system such as either a “water mister” or other similar technology and supporting HEPA filters will be installed, along with all required temporary power and water supplies.

The Main Warehouse will be utilized by the Site Infrastructure Plan (see Section 4.1.1.2.2) as a radioactive waste sorting and staging area during the demolition of contaminated structures. In order to support this function as long as possible, the warehouse will be removed at the end of the building demolition schedule. There are no specific requirements or project uses for the Liquids Storage Facility, and it will be removed in accordance with the project schedule. Due to its proximity, demolition of this structure will most likely occur during the same time frame as the Main Warehouse.

Methodologies and Techniques

The demolition and removal of all Zone 3 structures can be performed by a standard industrial demolition team, using standard demolition techniques including, but not limited to, the following types of equipment:

- Hydraulic hoe-rams
- Hydraulic shears
- Concrete pulverizers
- Universal processors
- Articulated wheel load grapples, track-mounted backhoe grapples, and track-mounted backhoe “thumbs”
- On-site trucks

For larger structures such as the Main Warehouse, the demolition will advance from the top down on a column bay by column bay basis (e.g., demolish everything between column line A to column line B, column line B to column line C, etc.).

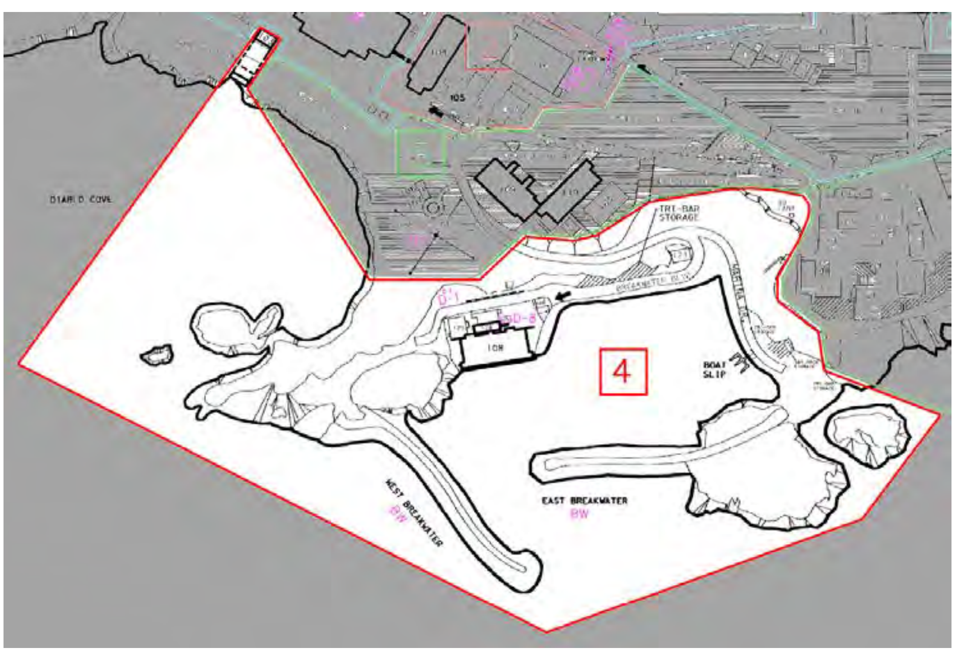
The ground adjacent to the foundations that require removal will be sloped or benched in accordance with standard construction criteria (CalOSHA) to prevent excavation instability, and ramps will be excavated in strategic locations so that demolition and debris removal equipment (backhoes and dump trucks) can access the area as needed.

In keeping with efficient demolition work practices and good housekeeping objectives, the demolition debris will be moved away from the active demolition area in a safe and expeditious manner to reduce interferences. Once removed away from the active demolition area, the demolition debris will be segregated by materials (i.e., structural steel, concrete rubble, general debris, etc.) to the greatest extent practicable and then loaded onto a transport vehicle and moved to the waste processing area for further dispositioning. The area will then be turned over to the Final Site Restoration scope of work (see Section 4.1.3.1) for performance of final site survey, backfill, and landscaping activities.

4.1.3.2.4. Building Demolition Zone 4

Zone 4 consists of an area outside of the main PA that encompasses the seawater and other structures located near the waterline of the Pacific Ocean. None of the structures in Zone 4 are inside the RCA; however, there is a possibility that some amount of radiological contamination may be present in the Discharge Structure because it contained the discharge point for the liquid radioactive waste system. See Figure 4-68 for relative locations of the plant buildings within Zone 4.

Figure 4-68: Zone 4 Buildings



The following is a detailed list of permanent plant structures and facilities within Zone 4 to be demolished:

- Discharge Structure (Bldg. 103) – A robust reinforced concrete structure that is built into the coastal bluffside, in a stepdown profile, to discharge and dissipate ocean water that was used for plant cooling and other permitted liquid wastes. The top structure elevation is at 90' and the lowest base slab elevation is at (-) 7.5’. Where possible, the walls were formed directly against sound rock and rock anchors were drilled into the bedrock. There are no hazardous materials stored in this building; however, portions of the structure may be contaminated due to the type of liquids that are discharged through it.
- U-1 and U-2 Intake Structure (Bldg. 108) – Houses the equipment used to draw ocean water into the plant for cooling. It is 104’ by 240’ and consists of reinforced concrete construction on a slab with perimeter footings. The top structure elevation is 17.5' Mean Sea Level (MSL) and the foundation mat extends down to elevation -38.0’. There are no contaminated areas or hazardous materials stored in this building.
- Intake Access Facility (Bldg. 108A) – Provides the main pathway for allowing access into the remote Intake Structure Protected Area. This building is 47 ft. by 25 ft. by 12 ft. tall and consists of masonry block construction on a slab with perimeter footings. There are no contaminated areas or hazardous materials stored in this building.
- TES Shower/Lab Facility (Bldg. 123) – Serves as office and working space for the biologists and contract divers located at the Intake Cove area. This modular building is 60 ft. by 36 ft. by 12 ft. tall. There are no contaminated areas or hazardous materials stored in this building.
- Intake Control Building (Bldg. 128) – Consists of an electrical control building for both units’ components located within the Intake Structure, as well as offices and storage for maintenance and operations personnel stationed at the Intake Structure. This building is 85 ft. by 60 ft. by 14 ft. tall and consists of masonry block construction on a slab with perimeter and column footings. There are no contaminated areas or hazardous materials stored in this building.
- Intake Maintenance Shop (Bldg. 129) – Serves as a main workshop and materials storage area for the Intake personnel. This building is 67 ft. by 66 ft. by 25 ft. tall and consists of concrete block construction on a slab with perimeter and column footings; it contains an internally mounted overhead bridge crane. There are no contaminated areas or hazardous materials stored in this building.
- East and West Breakwaters (Bldg. BW) – There are two breakwaters that help to form the Intake Cove: East Breakwater and West Breakwater. Each breakwater is constructed of precast rip-rap (tri-bars) placed over multiple layers of crushed rock and capped with a reinforced concrete slab for stability. The top slabs of the breakwaters are at approximately 20’ elevation. The bottom of the breakwaters extends as far down as (-)40’ elevation.
- Underground Sewage Holding Tank/Lift Station (Bldg. D-01) – Serves as sewage holding tank for the Intake area and provides a lift pump to move the effluent to the sewage treatment plant. This underground concrete reinforced concrete tank structure is 7 ft. by 13 ft. by 12 ft. deep.

There are no contaminated areas in this structure; however, the structure would require decontamination and cleaning prior to demolition.

- Chemical Storage Tanks and Pad (Bldg. D-08) – Storage tanks for chemicals that are injected into the circulating water tunnels and auxiliary saltwater piping to minimize internal sea growth. These are three 14 ft. diameter by 15 ft. tall tanks that rest on a 46 ft. by 20 ft. slab on grade with perimeter footings. There are no contaminated areas in this structure; however, the tanks will require decontamination and cleaning prior to demolition.

The only buildings in Zone 4 classified as heavy industrial demolition projects are the Intake Structure, Discharge Structure, and Breakwaters because these buildings are not unique in how they were built or what they contain. All other buildings in Zone 4 are not classified as heavy industrial demolition projects. The Intake and Discharge Structures, although logistically difficult because of their proximity to the ocean, will still use standard demolition techniques, as discussed below. Building demolition scope for these facilities consists of complete demolition and removal of all structures above grade and removal of all or some foundations. A study performed by PG&E to evaluate the extent of foundation removal for each structure recommends the following:

- Discharge Structure (Bldg. 103) – full removal
- Unit 1 and Unit 2 Intake Structure (Bldg. 108) – full removal
- Intake Access Facility (Bldg. 108A) – full removal
- TES Shower/Lab Facility (Bldg. 123) – modular facility does not have foundation
- Intake Control Building (Bldg. 128) – full removal of all foundations
- Intake Maintenance Shop (Bldg. 129) – full removal of all foundations
- East and West Breakwaters (Bldg. BW) – full removal
- Underground Sewage Holding Tank/Lift Station (Bldg. D-01) – full removal
- Chemical Storage Tanks and Pad (Bldg. D-08) – full removal of all foundations

Schedule

The following activities will be performed to prepare the Zone 4 structures for demolition:

- A pre-demolition engineering report required by Standard Number 1926.850(a) of Chapter 29 of the Code of Federal Regulations, Subpart T, will be prepared.
- All known hazardous and/or regulated materials will be removed from the structures.
- All system equipment, piping, components, electrical switchgear, etc., designated for removal will be removed from the interior confines of the structures.
- All remaining equipment, piping, components, etc., will be drained, purged, and air gapped.
- The structures will be in a “cold-and-dark” condition prior to the onset of interior demolition activities.
- Radiation protection personnel will survey and release the structure for demolition to Open Air Demolition criteria.

- If required by the work plans, a dust suppression system such as either a “water mister” or other similar technology and supporting HEPA filters will be installed, along with all required temporary power and water supplies.

Because the Discharge Structure spans the Main Protected Area boundary, this structure is a physical barrier and required to be in place to support the Security plan. It will be demolished after the spent fuel and GTCC waste have been relocated to the ISFSI and the PA removed.

The Unit 1 and Unit 2 Intake Structure contains equipment that provides cooling water to the SFP cooling system, which is required to be in place to support spent fuel cooling until the SFPI is installed. Demolition of the Intake Structure is currently scheduled so that its completion occurs just before major demolition of the main power block structures in Zone 1. Other smaller structures in the vicinity of the Intake Structure (i.e., the Intake Access Facility, Intake Control Building, Intake Maintenance Shop, Underground Sewage Holding Tank/Lift Station, Chemical Storage Tanks and Pad, and the TES Shower/Lab Facility) are planned to be demolished just prior to demotion of the Intake Structure to utilize the same construction equipment and resources.

Demolition of the East and West Breakwaters cannot occur until after the Intake Structure and associated cofferdam are removed. In order to levelize waste streams, the Breakwater is currently scheduled to be removed after the main power block structures in Zone 1 are removed and the material disposed of off-site.

Methodologies and Techniques

With the exception of the Breakwater, the demolition and removal of all Zone 4 structures can be performed by standard heavy and non-heavy industrial demolition teams, using standard demolition techniques including, but not limited to, the following types of equipment:

- Hydraulic hoe-rams
- Hydraulic shears
- Concrete pulverizers
- Universal processors
- Articulated wheel load grapples, track-mounted backhoe grapples, and track-mounted backhoe “thumbs”
- On-site trucks

For larger structures, the demolition will advance from the top down on a column bay by column bay basis (e.g., demolish everything between column line A to column line B, column line B to column line C, etc.).

The ground adjacent to the foundations that require removal will be sloped or benched in accordance with standard construction criteria (CalOSHA) to prevent excavation instability, and ramps will be excavated in strategic locations so that demolition and debris removal equipment (backhoes and dump trucks) can access the area as needed.

The different waste components will be separated after demolition and transferred to a pre-determined location for processing, packaging, and disposal. The area will then be turned over to the Final Site Restoration scope of work (see Section 4.1.3.1) for performance of final site survey, backfill, and landscaping activities.

Intake Structure

Two demolition challenges unique to the Intake Structure were also considered by demolition experts:

1.) Installing/constructing a cutoff wall (also called a cofferdam) to prohibit the intrusion of ocean water into the active demolition area
2.) The means-and-methods to remove the four circulating water pumps situated in the Intake Structure

The first challenge will require significant engineering and extensive background with design and installation of coffer dams) so that ocean water will not migrate into the demolition area. To facilitate installation and use of a cofferdam, permitting and associated compliance with any permitting conditions will be necessary. In addition, the installation of a cofferdam to support removal of the Intake Structure will require the Breakwater to remain in place to provide protection from wave action.

The second challenge – removing the existing large equipment in the Intake Structure – was evaluated using the following options:

- After installing the cutoff wall and operating the dewatering system for a suitable duration of time to make certain that the ocean water intrusion concern has been eliminated, demolish a sufficient amount of the above MSL portion of the Intake Structure so that a ramp can be installed to provide a track-mounted backhoe access to the pumps to demolish the Intake Structure with a shear.
- Demolish a sufficient amount of the above the MSL portion of the Intake Structure to gain access to the pumps and subsequently dismantle the pumps as opposed to demolishing the same in-situ. The dismantled pump sections would be rigged to a crane and lifted out of the Intake Structure.

The first option was determined by demolition experts to be too difficult due to the shearing required at the pumps for removal. The second option would allow for pump removal and require using the cofferdam for a shorter amount of time. As a result, the second option is assumed in the Intake Structure demolition cost estimate. Note: The installation and removal of the cofferdam must take place prior to the removal of the breakwater structure, since it provides the required protection from wave action.

Discharge Structure:

Similar to the conditions at the Intake Structure, two challenges present themselves with regard to demolishing the Discharge Structure:

1.) Installing/constructing a cutoff wall to prohibit the intrusion of ocean water into the active demolition area
2.) The means-and-methods to access the Discharge Structure to demolish it

During the original construction of the Discharge Structure, a road was built to access the construction site. The access road served a dual purpose as it also functioned as a cutoff wall to prevent ocean water from entering the construction site.

To keep its demolition area dry, the Discharge Structure will be demolished by installing a cofferdam system and dewatering system similar to that planned at the Intake Structure. The cofferdam to support the Discharge Structure removal does not rely on the breakwater to be in place; therefore, there is no impact to Breakwaters' removal. The demolition of the Discharge Structure will be conducted by a track-mounted, lattice boomed, crane that can remove the overburden atop the Discharge Structure with either a dragline bucket or a clamshell bucket, and then demolish the structure with a 5-ton steel ingot. The demolition debris will be retrieved with either a dragline bucket or a clamshell bucket.

The different waste components will be separated after demolition and transferred to a pre-determined location for processing, packaging, and disposal. The area will then be turned over to the Final Site Restoration scope of work (see Section 4.1.3.1) for performance of final site survey, backfill, and landscaping activities.

Breakwater:

The East and West Breakwaters will be demolished and removed by a marine contractor, using either a clamshell bucket or a dragline on a work barge to remove the Breakwater's concrete rubble, tribars, and stone. The material that is removed will be transferred into a material barge that, when fully laden, will be pushed to the shoreline within the Intake Cove area by a tug boat, and the material will be offloaded from the barge onto the DCPP site (i.e., approximately 300 ft. of barge transport).

The marine contractor's equipment resources will consist of the following:

- Construction crane barge with a crane
- Material barges
- Ocean-going tug for tending the material barges
- Ocean-going tug to pull and reset anchors mooring the construction crane barge and the material barges
- A crew boat to shuttle the crew from the marine contractor's place of business to and from the DCPP site

Standard practice in the marine construction industry is to work a 7-day workweek to minimize costs as the marine contractor charges for its major equipment resources (e.g., construction crane barge, crane, material barges) on a daily basis, whether those equipment resources are working or not. Using this assumption of a 7-day, 12-hour per day workweek would result in a demolition duration of 13 months.

However, the key factor for the Breakwater's demolition duration is the amount of time required to move the breakwater's debris off-site and into an out-of-state disposal facility. Simply put, there is insufficient space at the DCPP site to stockpile debris to support this 13-month schedule and it would not be efficient or cost-effective because the debris would require handling multiple times during the disposal process. Further, final site restoration of the stockpile area must be deferred until the stockpiled material has been shipped off-site and the area has been subject to an FSS, impacting the completion of the Final Site Restoration Plan.

For these reasons, the time it would take to demolish the Breakwater been levelized to match that of the time it would take to dispose of the material -- 40 months. This would allow for the steady demolition, survey, and transport of the material from the active work area to the Pismo Beach Railyard.

Note: A portion of the West Breakwater failed in early 1981 and was reconstructed in mid-1982. The 1982 repair included the following:

- The installation of multiple embedment ribs to secure new concrete tribars to the residual portion of the West Breakwater via pumping concrete into its residual portion
- The installation of new concrete tribars
- Pumping concrete into the West Breakwater at the toe of the breakwater on both the ocean side and the intake cove side

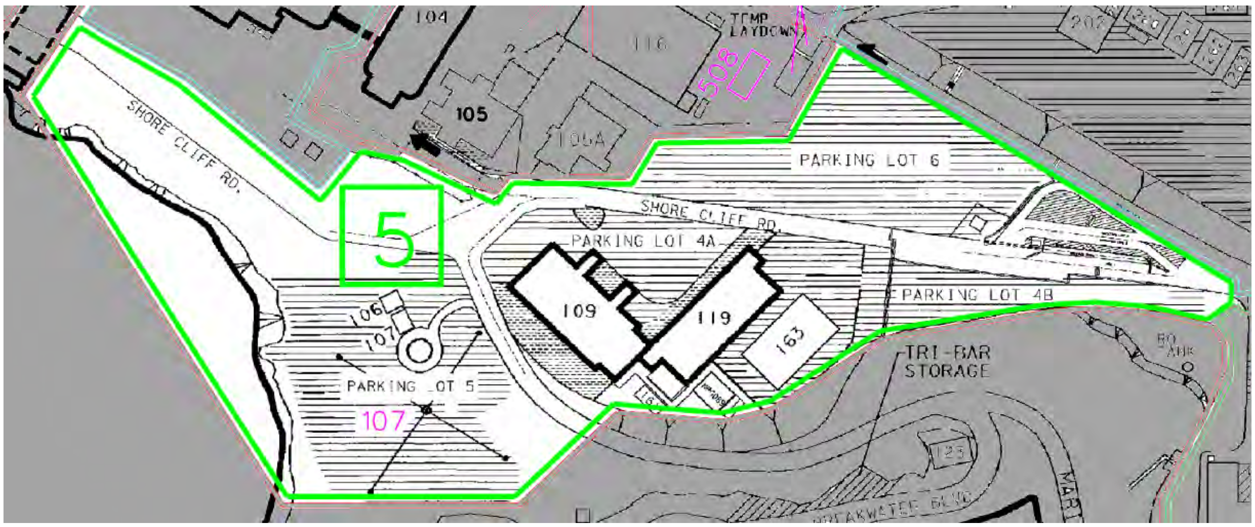
In addition, concrete was pumped into the ocean side toe of the East Breakwater during the same time to provide additional structural capacity.

The injected concrete to repair the Breakwater presents a significant demolition and removal challenge. The marine contractor will not be able to either rubblize or dislodge the injected concrete with either a clamshell bucket or a dragline. A track-mounted excavator on a work barge platform fitted with an extended boom can be utilized to dislodge the majority of the concrete with a hoe-ram. However, breaking up and dislodging the injected concrete will be problematic for the hoe-ram due to the depth of the injected concrete. The only other way to break up this concrete would be to use underwater explosives, which would require special discretionary permits. Based on previous PG&E experience obtaining similar permits, there is a high likelihood that it will not be able to obtain due to the potential environmental impacts.

4.1.3.2.5. Building Demolition Zone 5

Zone 5 consists of an area outside and directly south of the 85' main PA that encompasses the primary meteorological tower, simulator, training, and other support structures. None of the structures in Zone 5 are inside the RCA. See Figure 4-69 for relative locations of the plant buildings within Zone 5.

Figure 4-69: Zone 5 Buildings



The following is a detailed list of permanent plant structures and facilities within Zone 5 to be demolished:

- Telephone Terminal Building (Bldg. 106) – Serves as a main telephone terminal for the DCPP site. This building is 12 ft. by 18 ft. by 12 ft. tall and consists of pre-cast concrete building on a slab with perimeter footings. There are no contaminated areas or hazardous materials stored in this building.
- Meteorological Tower No. 1 and Building (Bldg. 107) – Serves as the main meteorological tower for the DCPP site and includes the associated maintenance building. The meteorological tower is 260’ tall and constructed of steel members on deep concrete pile foundation. Three groups of guy wires are positioned at various heights on the tower to provide stability and extend out up to 125’ from the base; they are anchored to deep concrete pile foundations. The associated maintenance building is 17 ft. by 26 ft. by 9 ft. tall and consists of block construction on a slab with perimeter footings. There are no contaminated areas or hazardous materials stored in the tower or building.
- Training Building (Bldg. 109) – Serves as the main training center for the DCPP site and includes the control room simulator. This building is 198 ft. by 129 ft. by 37 ft. tall and consists of steel construction on a slab with perimeter and column footings. There are no contaminated areas or hazardous materials stored in this building.
- Maintenance Shop Building (Bldg. 119) – Provides workshops, laboratories, the site library, and various office areas. This building is 260 ft. by 92 ft. by 50 ft. tall and consists of steel

construction on a slab with perimeter and column footings. There are no contaminated areas or hazardous materials stored in this building.

- Maintenance Shop Annex Building (Bldg. 161) – Provides additional office area to supplement the Maintenance Shop Building. This building is 12 ft. by 40 ft. by 10 ft. tall and consists of modular construction with deep piles. There are no contaminated areas or hazardous materials stored in this building.
- FFD/Access Building (Bldg. 163) – Provides office areas to aid in processing site access requests and facilitates compliance with fitness for duty monitoring requirements. This building is 108 ft. by 60 ft. by 10 ft. tall and consists of modular construction. There are no contaminated areas or hazardous materials stored in this building.
- SG Mock-up (Bldg. NPG089) – Houses the mock-up of a lower SG bowl that is used for training purposes. This metal building rests on a slab and is 40 ft. by 40 ft. by 14 ft. tall. There are no contaminated areas or hazardous materials stored in this building.

The Zone 5 buildings are standard concrete block, steel, or modular buildings built on slabs with minimal footings (perimeter and column). The internal structure environments are either typical office buildings or workshops and do not contain hazardous materials. Because these buildings are not unique in how they were built or what they contain, the buildings in Zone 5 are not classified as heavy industrial demolition projects. Building demolition scope for these facilities consists of complete demolition and removal of all structures above grade and removal of all or some foundations. A study performed by PG&E to evaluate the extent of foundation removal for each structure recommends the following:

- Telephone Terminal Building (Bldg. 106) – full removal of all foundations
- Meteorological Tower No. 1 and Building (Bldg. 107) – 3’ below grade
- Training Building (Bldg. 109) – 3’ below grade
- Maintenance Shop Building (Bldg. 119) – 3’ below grade
- Maintenance Shop Annex Building (Bldg. 161) – 3’ below grade
- FFD/Access Building (Bldg. 163) – full removal of all foundations
- SG Mock-up (Bldg. NPG089) – full removal of all foundations

Schedule

The following activities will be performed to prepare the Zone 5 structures for demolition:

- A pre-demolition engineering report required by Standard Number 1926.850(a) of Chapter 29 of the Code of Federal Regulations, Subpart T, will be prepared.
- All known hazardous and/or regulated materials will be removed from the structures.
- All system equipment, piping, components, electrical switchgear, etc., designated for removal will be removed from the interior confines of the structures.
- All remaining equipment, piping, components, etc., will be drained, purged, and air gapped.
- The structures will be in a “cold-and-dark” condition prior to the onset of demolition activities.

- Radiation protection personnel will survey and release the structure for demolition to Open Air Demolition criteria.
- If required by the work plans, a dust suppression system such as either a "water mister" or other similar technology and supporting HEPA filters will be installed, along with all required temporary power and water supplies.

The Training and Maintenance Shop buildings will be utilized by the Site Infrastructure Plan as office space during the decommissioning project. Several nearby facilities that are not utilized by the project (i.e., the Maintenance Shop Annex Building, FFD/Access Building, SG Mock-up) are relatively close to the other structures; and their removal is scheduled to occur with these two other buildings to minimize mobilization costs and maximize production. In order to support this function as long as possible, these facilities are therefore scheduled to be removed at the end of the building demolition schedule.

The Telephone Terminal Building and Meteorological Tower No. 1 and Building are required to support telecommunications needs during the decommissioning project. To support the required function as long as possible, these facilities are scheduled to be removed after main power block demolition.

Methodologies and Techniques

The demolition and removal of all Zone 5 structures can be performed by a standard industrial demolition team, using standard demolition techniques including, but not limited to, the following types of equipment:

- Hydraulic hoe-rams
- Hydraulic shears
- Concrete pulverizers
- Universal processors
- Articulated wheel load grapples, track-mounted backhoe grapples, and track-mounted backhoe "thumbs"
- On-site trucks

For larger structures such as the Training Building, the demolition will advance from the top down on a column bay by column bay basis (e.g., demolish everything between column line A to column line B, column line B to column line C, etc.)

The ground adjacent to the foundations that require removal will be sloped or benched in accordance with standard construction criteria (CalOSHA) to prevent excavation instability, and ramps will be excavated in strategic locations so that demolition and debris removal equipment (backhoes and dump trucks) can access the site as needed.

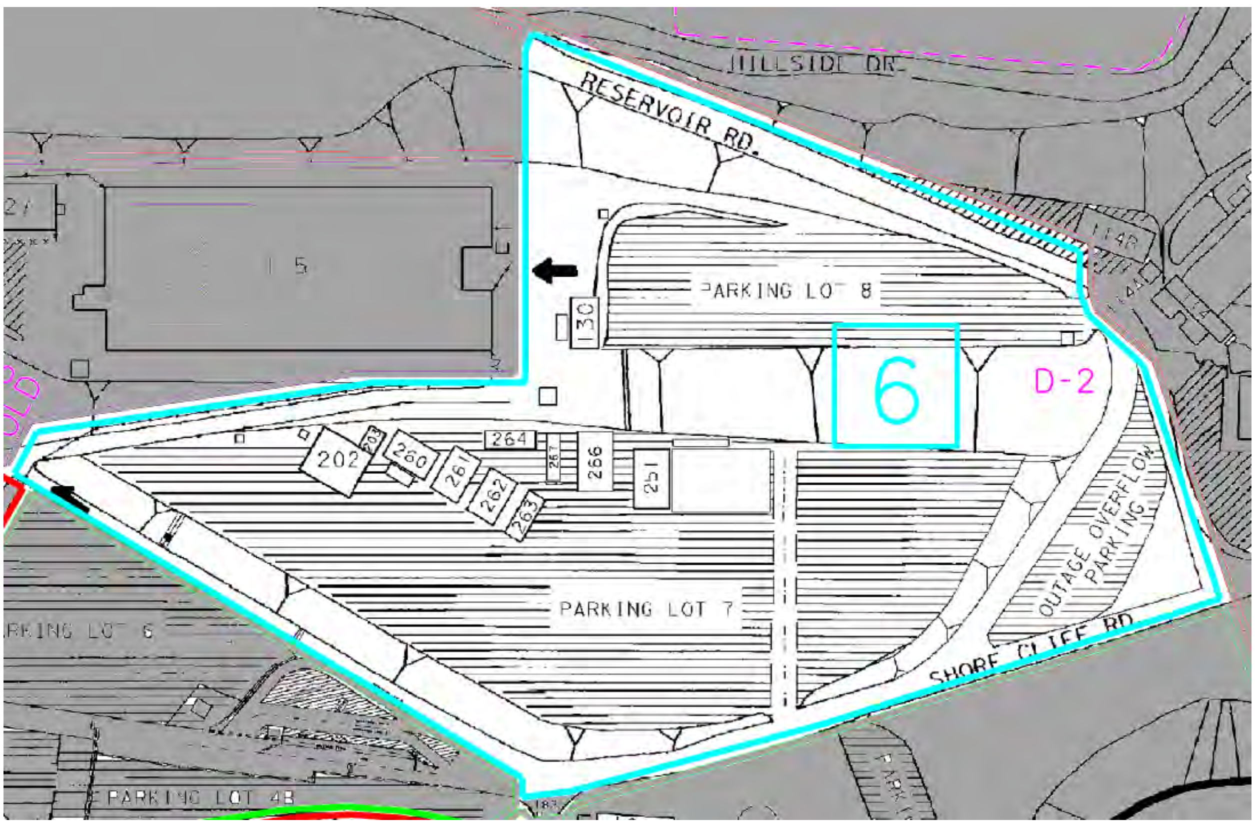
In keeping with efficient demolition work practices and good housekeeping objectives, the demolition debris will be moved away from the active demolition area in a safe and expeditious manner to reduce

interferences. Once removed away from the active demolition area, the demolition debris will be segregated by materials (i.e., structural steel, concrete rubble, general debris, etc.) to the greatest extent practicable and then loaded onto a transport vehicle and moved to the waste processing area for further dispositioning. The area will then be turned over to the Final Site Restoration scope of work (see Section 4.1.3.1) for performance of final site survey, backfill, and landscaping activities.

4.1.3.2.6. Building Demolition Zone 6

Zone 6 consists of an area outside the main PA and directly south of the Main Warehouse and encompasses the area where the original construction offices and parking lots are located. None of the structures in Zone 6 are inside the RCA. See Figure 4-70 for relative locations of the plant buildings within Zone 6.

Figure 4-70: Zone 6 Buildings



The following is a detailed list of permanent plant structures and facilities within Zone 6 to be demolished:

- Gas Cylinder Enclosure (Bldg. 130) – Serves as a storage location for delivery and pick-up of compressed gas cylinders. This open structure is 60 ft. by 32 ft. by 8 ft. tall and consists of concrete block construction on a slab with perimeter footings. The southernmost wall of this structure also acts as a retaining wall. There are no contaminated areas or hazardous materials stored in this building.

- Storage (Bldg. 202) – Serves as a storage building for the facility maintenance department. This pre-fabricated metal building rests on a slab and is 60 ft. by 75 ft. by 12 ft. tall. There are no contaminated areas or hazardous materials stored in this building.
- Telecommunications / SGI Vault Building (Bldg. 203) – Serves as a telecommunications equipment facility. This concrete block building rests on a slab and is 20 ft. by 25 ft. by 10 ft. tall and is attached to Bldg. 202. There are no contaminated areas or hazardous materials stored in this building.
- Industrial Fire Operations Garage (Bldg. 251) – This facility was originally installed to house the fire brigade apparatus (fire trucks, etc.); however, the fire brigade has been relocated to Building 113. This facility now serves as storage for facilities maintenance department materials and equipment. This building is 40 ft. by 85 ft. by 20 ft. tall and consists of metal construction on a slab with perimeter and column footings. There are no contaminated areas or hazardous materials stored in this building.
- SG Maintenance (Bldg. 260) – Serves as office facilities. This building is 36 ft. by 60 ft. by 20 ft. tall and consists of modular construction with perimeter footings. There are no contaminated areas or hazardous materials stored in this building.
- Day-Zimmerman/Construction Field Engineering (Bldg. 261) – Serves as office facilities. This building is 36 ft. by 60 ft. by 20 ft. tall and consists of modular construction with perimeter footings. There are no contaminated areas or hazardous materials stored in this building.
- Facility Maintenance/Conference room/In-processing (Bldg. 262) – Serves as office facilities. This building is 36 ft. by 60 ft. by 20 ft. tall and consists of modular construction with perimeter footings. There are no contaminated areas or hazardous materials stored in this building.
- Fire Brigade (Bldg. 263) – This facility previously housed the fire brigade personnel in their crew quarters; however, the fire brigade has been relocated to Building 113. It now serves as office facilities. This building is 24 ft. by 60 ft. by 20 ft. tall and consists of modular construction with perimeter footings. There are no contaminated areas or hazardous materials stored in this building.
- Conference room/TCOM/Storage (Bldg. 264) – Serves as office facilities. This building is 24 ft. by 60 ft. by 20 ft. tall and consists of modular construction with perimeter footings. There are no contaminated areas or hazardous materials stored in this building.
- Offices (Bldg. 266) – Serves as office facilities. This building is 60 ft. by 72 ft. by 12 ft. tall and consists of modular construction. There are no contaminated areas or hazardous materials stored in this building.
- Toilets (Bldg. 267) – Serves as a restroom facility for offices in the area. This building is 12 ft. by 60 ft. by 12 ft. tall and consists of modular construction. There are no contaminated areas or hazardous materials stored in this building.
- Small Storage Building and Tank (Bldg. D-02) – The building serves as storage for the shooting range, and the small tank provides surge protection for Building 113. This metal building rests on

a slab and is 15 ft. x 30 ft. by 15 ft. tall and the nearby tank is approximately 12 ft. in diameter x 15' tall and is of high density plastic construction. There are no contaminated areas or hazardous materials stored in this building or associated tank.

The Zone 6 buildings are standard concrete, metal, or modular buildings built on slabs with minimal footings (perimeter and column). The internal structure environments are either typical office buildings or workshops/garages and do not contain hazardous materials. Because these buildings are not unique in how they were built or what they contain, the buildings in Zone 6 are not classified as heavy industrial demolition projects. Building demolition scope for these facilities consists of complete demolition and removal of all structures above grade and removal of all or some foundations. A study performed by PG&E to evaluate the extent of foundation removal for each structure recommends the following:

- Gas Cylinder Enclosure (Bldg. 130) – 3' below grade
- Storage (Bldg. 202) – full removal of all foundations
- Telecommunications / SGI Vault Building (Bldg. 203) – full removal of all foundations
- Industrial Fire Operations Garage (Bldg. 251) – full removal of all foundations
- SG Maintenance (Bldg. 260) – full removal of all foundations
- Day-Zimmerman/Construction Field Engineering (Bldg. 261) – full removal of all foundations
- Facility Maintenance/Conference room/In-processing (Bldg. 262) – full removal of all foundations
- Fire Brigade (Bldg. 263) – full removal of all foundations
- Conference room/TCOM/Storage (Bldg. 264) – full removal of all foundations
- Offices (Bldg. 266) – full removal of all foundations
- Toilets (Bldg. 267) – full removal of all foundations
- Small Storage Building and Tank (Bldg. D-02) – full removal of all foundations

Schedule

The following activities will be performed to prepare the Zone 6 structures for demolition:

- A pre-demolition engineering report required by Standard Number 1926.850(a) of Chapter 29 of the Code of Federal Regulations, Subpart T, will be prepared.
- All known hazardous and/or regulated materials will be removed from the structures.
- All system equipment, piping, components, electrical switchgear, etc., designated for removal will be removed from the interior confines of the structures.
- All remaining equipment, piping, components, etc., have been drained, purged, and air gapped.
- The structures will be in a "cold-and-dark" condition prior to the onset of demolition activities.
- Radiation protection personnel will survey and release the structure for demolition to Open Air Demolition criteria.
- If required by the work plans, a dust suppression system such as either a "water mister" or other similar technology and supporting HEPA filters will be installed, along with all required temporary power and water supplies

The Industrial Fire Operations Garage, Offices, and Toilet buildings will be utilized by the Site Infrastructure scope of work as office space during the decommissioning project (see Section 4.1.3.1). In order to support this function as long as possible, these facilities are scheduled to be removed at the end of the building demolition schedule.

The remaining buildings and structures in this zone have no specific requirements or project uses and will be removed in accordance with the project schedule. Their removal has been scheduled to minimize mobilization and demobilization costs of a demolition contractor, as well as levelized waste streams and disposal costs. Note: The Gas Cylinder Enclosure must be removed before setting up the Main Warehouse (Building 115) as a radioactive waste sorting and staging area by the Site Infrastructure scope of work (see Section 4.1.3.1).

Methodologies and Techniques

The demolition and removal of all Zone 6 structures can be performed by a standard industrial demolition team, using standard demolition techniques including, but not limited to, the following types of equipment:

- Hydraulic hoe-rams
- Hydraulic shears
- Concrete pulverizers
- Universal processors
- Articulated wheel load grapples, track-mounted backhoe grapples, and track-mounted backhoe "thumbs"
- On-site trucks

For larger structures such as the Industrial Fire Operations Garage, the demolition will advance from the top down on a column bay by column bay basis (e.g., demolish everything between column line A to column line B, column line B to column line C, etc.)

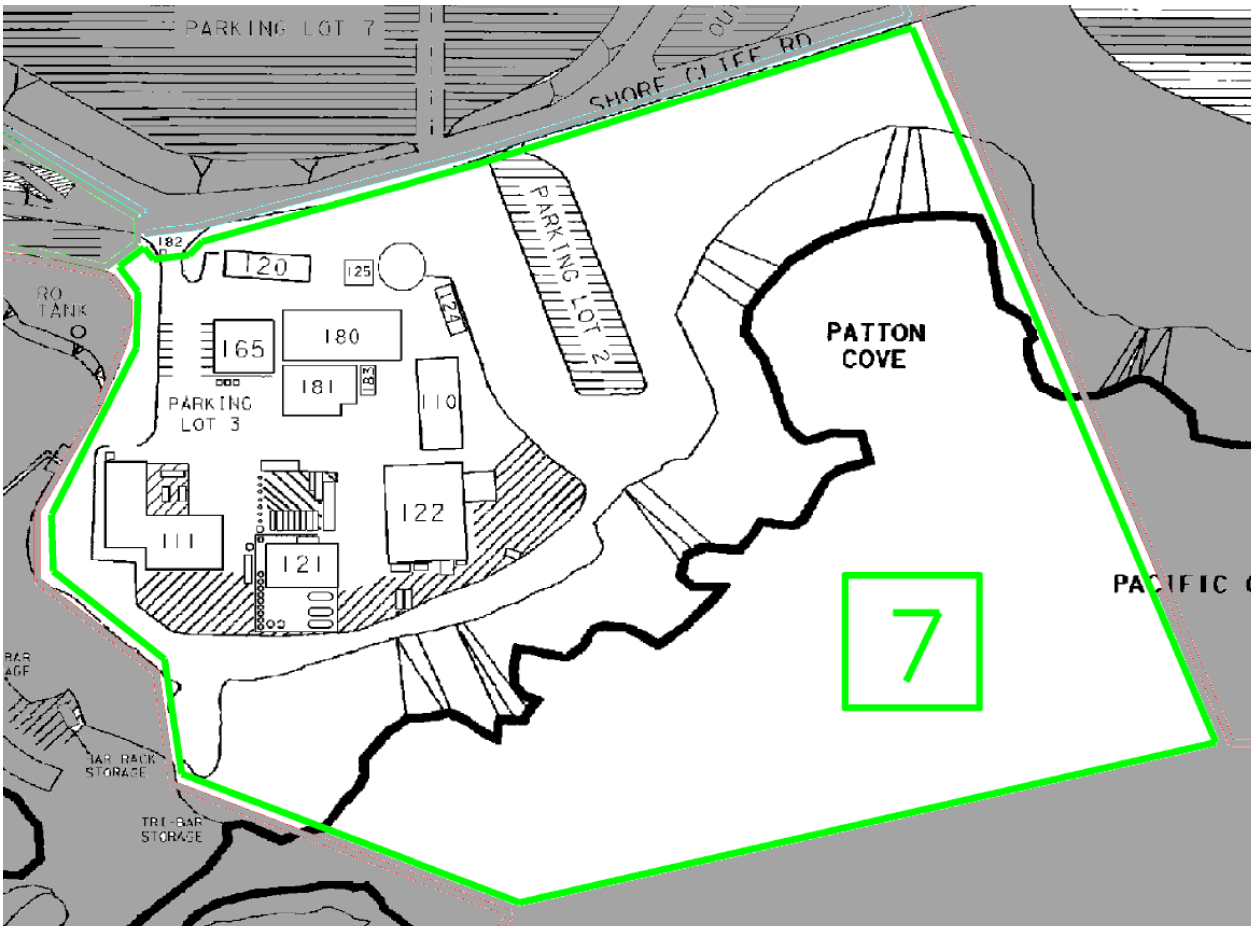
The ground adjacent to the foundations that require removal will be sloped or benched in accordance with standard construction criteria (CalOSHA) to prevent excavation instability, and ramps will be excavated in strategic locations so that demolition and debris removal equipment (backhoes and dump trucks) can access the area as needed.

In keeping with efficient demolition work practices and good housekeeping objectives, the demolition debris will be moved away from the active demolition area in a safe and expeditious manner to reduce interferences. Once removed away from the active demolition area, the demolition debris will be segregated by materials (i.e., structural steel, concrete rubble, general debris, etc.) to the greatest extent practicable and then loaded onto a transport vehicle and moved to the waste processing area for further dispositioning. The area will then be turned over to the Final Site Restoration scope of work (see Section 4.1.3.1) for performance of final site survey, backfill, and landscaping activities.

4.1.3.2.7. Building Demolition Zone 7

Zone 7 consists of an area outside the main PA in an area commonly known as "Patton Flats." This area is on the bluff overlooking the intake cove, west of the main access road, and south of the main plant area and Zones 4, 5, and 6. None of the structures in Zone 7 are inside the RCA. See Figure 4-71 for relative locations of the plant buildings within Zone 7.

Figure 4-71: Zone 7 Buildings



The following is a detailed list and description of permanent plant structures and facilities within Zone 7 to be demolished:

- Sandblasting and Spray Paint Facility (Bldg. 110) – Serves as an enclosed and environmentally controlled area to prepare and apply coatings to plant-related materials and equipment. This building is 40 ft. by 100 ft. by 21 ft. tall and consists of steel construction on a slab with perimeter footings. This area has been used for the application of coatings; therefore, hazardous materials have been utilized and stored in this building. There are no contaminated areas in this facility.

- Turbine Generator and Rotor Equipment Warehouse (Bldg. 111) – Serves as a storage location for a spare main generator, rotor, the ISFSI cask transporter, and other miscellaneous large spare plant equipment. This L-shaped building is 125 ft. by 135 ft. by 25 ft. tall and consists of pre-fabricated metal construction on a slab with perimeter footings. There are no contaminated areas or hazardous materials stored in this building.
- Hazardous Waste Facility (Bldg. 120) – Serves as a processing and storage area for hazardous material on-site. This building is 36 ft. by 100 ft. by 20 ft. tall and consists of steel construction on a slab with perimeter and column footings. Due to the nature of this facility, hazardous materials have been utilized and stored in this building. There are no contaminated areas in this facility.
- Seawater Reverse Osmosis Facility (Bldg. 121) – Serves as a control building for the reverse osmosis facility, which includes offices, storage, and chemical processing. This building is 42 ft. by 80 ft. by 18 ft. tall and consists of pre-fabricated metal construction on a slab with perimeter and column footings. There are no contaminated areas in this facility; however, hazardous materials have been used in this building.
- Fabrication Shop (Bldg. 122) – Serves as a fabrication shop for the on-site maintenance contractor. This building is 100 ft. by 126 ft. by 18 ft. tall and consists of steel construction on a slab with perimeter and column footings. There are no contaminated areas in this facility; however, hazardous materials have been used in this building.
- Sewage Treatment Plant (Bldg. 124) – Serves as a sewage holding basin and processing area for the site's sewage system. This facility is essentially a square-shaped, deep open basin of concrete construction, with an associated concrete slab on grade for mounting equipment. The basin is 49 ft. by 14 ft. by 4 ft. high above local grade and extends 13 ft. below grade (overall height of the basin is therefore 17 ft.); the equipment slab is 6 ft. by 21 ft. by 1-ft. thick concrete. There are no contaminated areas or hazardous materials stored in this facility.
- Fire Water Tank and Pumphouse (Bldg. 125) – This facility consists of a 470,000-gallon capacity tank used to store firewater on-site and a nearby pump house for distributing that water to the underground firewater piping system. The tank is 50 ft. in diameter and 32 ft. tall. The pump house building is 22 ft. by 27 ft. by 11 ft. tall and consists of pre-fabricated metal construction on a slab with perimeter and column footings. There are no contaminated areas or hazardous materials stored in either the tanks or the building.
- Used Fuel Storage Project (Bldg. 165) – Serves as office space. This modular building is 55 ft. by 55 ft. by 12 ft. tall. There are no contaminated areas or hazardous materials stored in this building.
- Modular Building (Bldg. 180) – Serves as office space. This building is 60 ft. by 120 ft. by 12 ft. tall and consists of modular construction with no foundation. There are no contaminated areas or hazardous materials stored in this building.

- Modular Building (Bldg. 181) – Serves as office space. This building is 60 ft. by 84 ft. by 12 ft. tall and consists of modular construction with no foundation. There are no contaminated areas or hazardous materials stored in this building.
- TCOM Building (Bldg. 182) – Serves as a telecommunications equipment storage building. This building is 8 ft. by 8 ft. by 9 ft. tall and consists of a pre-fabricated modular building on a concrete slab. There are no contaminated areas or hazardous materials stored in this building.
- Modular Building (Bldg. 183) – Serves as a restroom facility for offices located in the area. This building is 12 ft. by 40 ft. by 12 ft. tall and consists of modular construction with no foundation. There are no contaminated areas or hazardous materials stored in this building.

The Zone 7 buildings are standard concrete, metal, or modular buildings built on slabs with minimal footings (perimeter and column). The internal structure environments are either typical office buildings or workshops/garages and do not contain hazardous materials. Because these buildings are not unique in how they were built or what they contain, the buildings in Zone 7 are not classified as heavy industrial demolition projects. Building demolition scope for these facilities consists of complete demolition and removal of all structures above grade and removal of all or some foundations. A study performed by PG&E to evaluate the extent of foundation removal for each structure recommends the following:

- Sandblasting and Spray Paint Facility (Bldg. 110) – 3' below grade
- Turbine Generator and Rotor Equipment Warehouse (Bldg. 111) – 3' below grade
- Hazardous Waste Facility (Bldg. 120) – 3' below grade
- Seawater Reverse Osmosis Facility (Bldg. 121) – 3' below grade
- Fabrication Shop (Bldg. 122) – full removal of all foundations
- Sewage Treatment Plant (Bldg. 124) – full removal of all foundations
- Fire Water Tank and Pumphouse (Bldg. 125) – full removal of all foundations
- Used Fuel Storage Project (Bldg. 165) – full removal of all foundations
- Modular Building (Bldg. 180) – full removal of all foundations
- Modular Building (Bldg. 181) – full removal of all foundations
- TCOM Building (Bldg. 182) – full removal of all foundations
- Modular Building (Bldg. 183) – full removal of all foundations

Schedule

The following activities will be performed to prepare the Zone 7 structures for demolition:

- A pre-demolition engineering report required by Standard Number 1926.850(a) of Chapter 29 of the Code of Federal Regulations, Subpart T, will be prepared.
- All known hazardous and/or regulated materials will be removed from the structures.
- All system equipment, piping, components, electrical switchgear, etc., designated for removal have been removed from the interior confines of the structures.
- All remaining equipment, piping, components, etc., will be drained, purged, and air gapped.
- The structures will be in a "cold-and-dark" condition prior to the onset of demolition activities.

- Radiation protection personnel will survey and release the structure for demolition to Open Air Demolition criteria.
- If required by the work plans, a dust suppression system such as either a "water mister" or other similar technology and supporting HEPA filters will be installed, along with all required temporary power and water supplies.

Schedule

The SWRO Facility is required to remain in service as long as possible to support the Final Site Restoration activities' water needs, therefore, it is scheduled to be removed as late as possible (see Section 4.1.3.1).

The Sewage Treatment Plant is required to support the liquid discharge needs of the project during implementation (see Section 4.1.1.2.2), therefore, it is scheduled to be removed after all major liquid discharges are completed and the Discharge Structure is no longer needed.

The remaining buildings and structures in this zone have no specific requirements or project uses and will be removed in accordance with the project schedule. Their removal has been scheduled to minimize mobilization and demobilization costs of a demolition contractor, as well as levelized waste streams and disposal costs.

Methodologies and Techniques

The demolition and removal of all Zone 7 structures can be performed by a standard industrial demolition team, using standard demolition techniques including, but not limited to, the following types of equipment:

- Hydraulic hoe-rams
- Hydraulic shears
- Concrete pulverizers
- Universal processors
- Articulated wheel load grapples, track-mounted backhoe grapples, and track-mounted backhoe "thumbs"
- On-site trucks

For larger structures such as the Turbine Generator and Rotor Equipment Warehouse, the demolition will advance from the top down on a column bay by column bay basis (e.g., demolish everything between column line A to column line B, column line B to column line C, etc.)

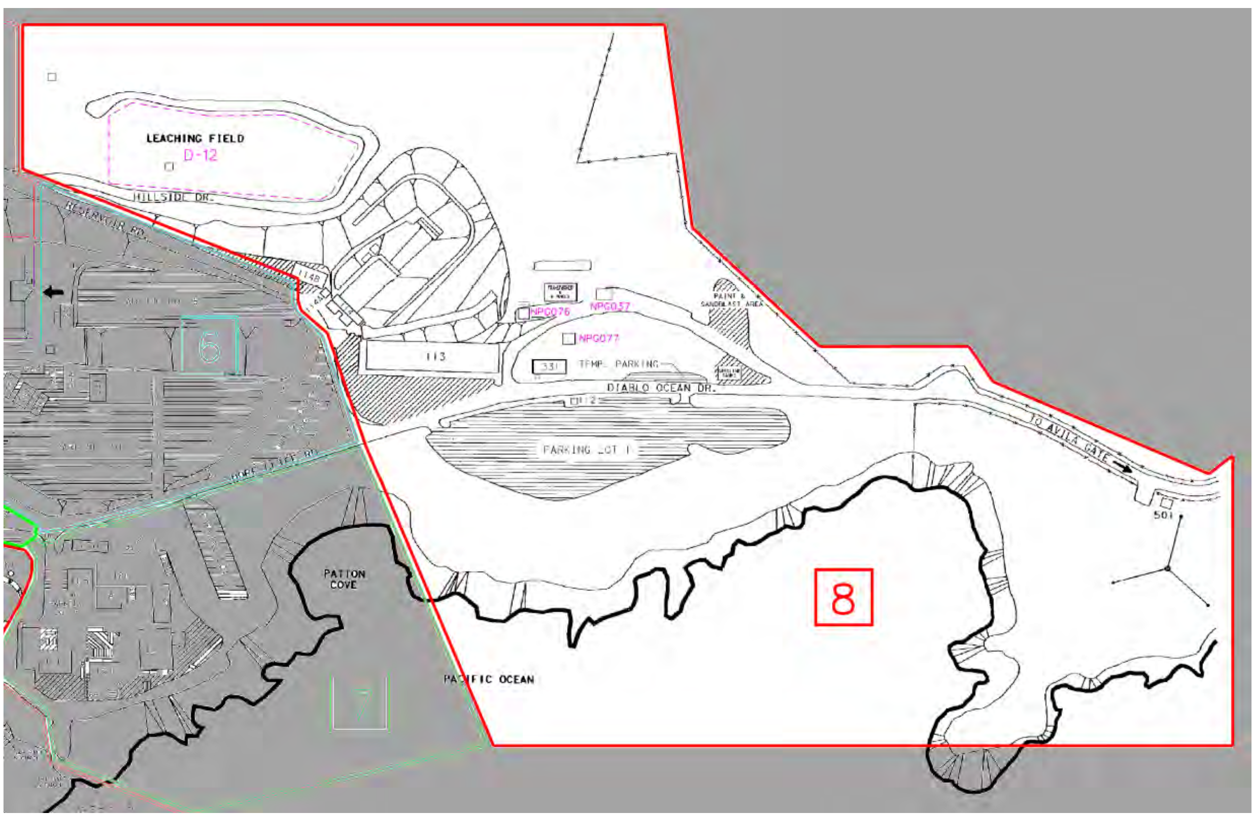
The ground adjacent to the foundations that require removal will be sloped or benched in accordance with standard construction criteria (CalOSHA) to prevent excavation instability, and ramps will be excavated in strategic locations so that demolition and debris removal equipment (backhoes and dump trucks) can access the area as needed.

In keeping with efficient demolition work practices and good housekeeping objectives, the demolition debris will be moved away from the active demolition area in a safe and expeditious manner to reduce interferences. Once removed away from the active demolition area, the demolition debris will be segregated by materials (i.e., structural steel, concrete rubble, general debris, etc.) to the greatest extent practicable and then loaded onto a transport vehicle and moved to the waste processing area for further dispositioning. The area will then be turned over to the Final Site Restoration scope of work (see Section 4.1.3.1) for performance of final site survey, backfill, and landscaping activities.

4.1.3.2.8. Building Demolition Zone 8

Zone 8 consists of an area outside the main PA in the southernmost portion of the owner-controlled area. This area contains the new fire department and the security shooting range and is south of Zones 6 and 7. None of the structures in Zone 8 are inside the RCA. See Figure 4-72 for relative locations of the plant buildings within Zone 8.

Figure 4-72: Zone 8 Buildings



The following is a detailed list and description of permanent plant structures and facilities within Zone 8 to be demolished:

- Warehouse "B" Fukushima FLEX Equipment Storage (Bldg. 113) – The northern portion of this building serves as a fire station for the on-site fire brigade. The center portion of this building stores emergency backup portable equipment required by post-Fukushima orders. The southern portion of this building houses the on-site access and badging office. This building is 85 ft. by 350 ft. by 27 ft. tall and consists of steel construction with deep piles on a concrete slab foundation with perimeter and column footings. There are no contaminated areas or hazardous materials stored in this building.

- Security Training Tower (Bldg. 114A) – Provides a higher point access at the firing range to support security department training. This building is 15 ft. by 19 ft. by 44 ft. tall and consists of pre-fabricated metal construction on a slab with perimeter footings. There are no contaminated areas or hazardous materials stored in this building.
- Security Training Building (Bldg. 114B) – Provides offices and training rooms to support security department training. This building is 60 ft. by 70 ft. by 13 ft. tall and consists of pre-fabricated metal construction on a slab with perimeter and column footings. There are no contaminated areas or hazardous materials stored in this building.
- Soils Lab (Bldg. 331) – Serves as a concrete testing facility. This building is 25 ft. by 80 ft. by 15 ft. tall and consists of pre-fabricated metal construction on a slab with perimeter footings. There are no contaminated areas or hazardous materials stored in this building.
- Secondary MET Tower and Control Building (Bldg. 501) – Serves as the secondary meteorological tower for the DCPP site and includes an associated maintenance building. The secondary meteorological tower is 200’ tall and constructed of steel members on a deep cast in place concrete pile foundation. Three groups of guy wires are positioned at various heights on the tower to provide stability and extend out up to 190’ from the base and are anchored to deep concrete pile foundations. The associated maintenance building is 14 ft. by 12 ft. by 9 ft. tall and consists of block construction on a slab with perimeter footings. There are no contaminated areas or hazardous materials stored in the tower or building.
- Office/Paint Storage (Bldg. NPG037) – Serves as a storage facility. This building is 25 ft. by 25 ft. by 10 ft. tall and consists of a pre-fabricated metal building on a slab. There are no contaminated areas in this facility; however, hazardous materials have been used in this building.
- Storage Facilities (Bldg. NPG076 and NPG077) – Serve as miscellaneous storage facilities. These buildings are timber construction on perimeter concrete footings or light concrete slabs. These buildings are approximately the same size and measure 25 ft. by 25 ft. by 10 ft. tall. There are no contaminated areas or hazardous materials stored in these buildings.
- Leach Field East of Lot 8, abandoned (Bldg. D-12) – Served as the leach field during original plant construction. This leach field was later abandoned after installation of the sewage treatment facility (Bldg. 124 located in Zone 7). There are four distinct leach field areas, each one approximately 225 ft. by 225 ft. in size, consisting of perforated pipe embedded in aggregate rock approximately 5 ft. deep. There are no contaminated areas associated with the leach fields.
- Equipment Shelter (Bldg. 112) – Also called the tertiary meteorological tower, this facility consists of a small meteorological tower and associated small storage building. This tower serves as a back-up meteorological tower to the secondary tower (Bldg. 501). The tower is 30 ft. tall

and constructed of steel members on a cast in place concrete foundation, with no guy wires. The associated storage building is 8 ft. by 12 ft. by 9 ft. tall and consists of block construction on a concrete slab with perimeter footings. There are no contaminated areas or hazardous materials stored in this building.

The Zone 8 buildings are standard concrete, metal, or modular buildings built on slabs with minimal footings (perimeter and column). The internal structure environments are either typical office buildings or workshops/garages and do not contain hazardous materials. Because these buildings are not unique in how they were built or what they contain, the buildings in Zone 8 are not classified as heavy industrial demolition projects. Building demolition scope for these facilities consists of complete demolition and removal of all structures above grade and removal of all or some foundations. A study performed by PG&E to evaluate the extent of foundation removal for each structure recommends the following:

- Warehouse “B” Fukushima FLEX Equipment Storage (Bldg. 113) – 3’ below grade
- Security Training Tower (Bldg. 114A) – 3’ below grade
- Security Training Building (Bldg. 114B) – full removal of all foundations
- Soils Lab (Bldg. 331) – full removal of all foundations
- Secondary MET Tower and Control Building (Bldg. 501) – 3’ below grade
- Office/Paint Storage (Bldg. NPG037) – full removal of all foundations
- Storage (Bldg. NPG076) – full removal of all foundations
- Storage (Bldg. NPG077) – full removal of all foundations
- Leach Field East of Lot 8, abandoned (Bldg. D-12) – full removal of all foundations
- Equipment Shelter (Bldg. 112) – full removal of all foundations

Schedule

The following activities will be performed to prepare the Zone 8 structures for demolition:

- A pre-demolition engineering report required by Standard Number 1926.850(a) of Chapter 29 of the Code of Federal Regulations, Subpart T, will be prepared.
- All known hazardous and/or regulated materials will be removed from the structures.
- All system equipment, piping, components, electrical switchgear, etc., designated for removal have been removed from the interior confines of the structures.
- All remaining equipment, piping, components, etc., will be drained, purged, and air gapped.
- The structures will be in a “cold-and-dark” condition prior to the onset of demolition activities.
- Radiation protection personnel will survey and release the structure for demolition to Open Air Demolition criteria.
- If required by the work plans, a dust suppression system such as either a “water mister” or other similar technology and supporting HEPA filters will be installed, along with all required temporary power and water supplies.

The Security Training Tower and Security Training Building are required to support the security plan and will be demolished after the spent fuel and GTCC waste has been relocated to the ISFSI and the main PA has been eliminated.

The Equipment Shelter and Secondary MET Tower and Control Building are required to support the emergency plan and are scheduled to be demolished after the spent fuel and GTCC waste have been relocated to the ISFSI and the PA removed.

Warehouse “B” Fukushima FLEX Equipment Storage will be utilized by the Site Infrastructure Plan as an environmental count room and laboratory to support the demolition of all structures on site (see Section 4.1.1.2.2). To support this function as long as possible, this facility is scheduled to be removed at the end of the building demolition schedule.

The remaining buildings and structures in this zone (i.e., the Soils Lab, Office/Paint Storage, Storage Buildings, and Leach Field east of Lot 8) have no specific requirements or project uses and will be removed in accordance with the project schedule. Their removal has been scheduled to minimize mobilization and demobilization costs of a demolition contractor, as well as levelized waste streams and disposal costs.

Methodologies and Techniques

The demolition and removal of all Zone 8 structures can be performed by a standard industrial demolition team, using standard demolition techniques including, but not limited to, the following types of equipment:

- Hydraulic hoe-rams
- Hydraulic shears
- Concrete pulverizers
- Universal processors
- Articulated wheel load grapples, track-mounted backhoe grapples, and track-mounted backhoe “thumbs”
- On-site trucks

For larger structures such as the Warehouse “B” Fukushima FLEX Equipment Storage, the demolition will advance from the top down on a column bay by column bay basis (e.g., demolish everything between column line A to column line B, column line B to column line C, etc.).

The ground adjacent to the foundations that require removal will be sloped or benched in accordance with standard construction criteria (CalOSHA) to prevent excavation instability, and ramps will be excavated in strategic locations so that demolition and debris removal equipment (backhoes and dump trucks) can access the area as needed.

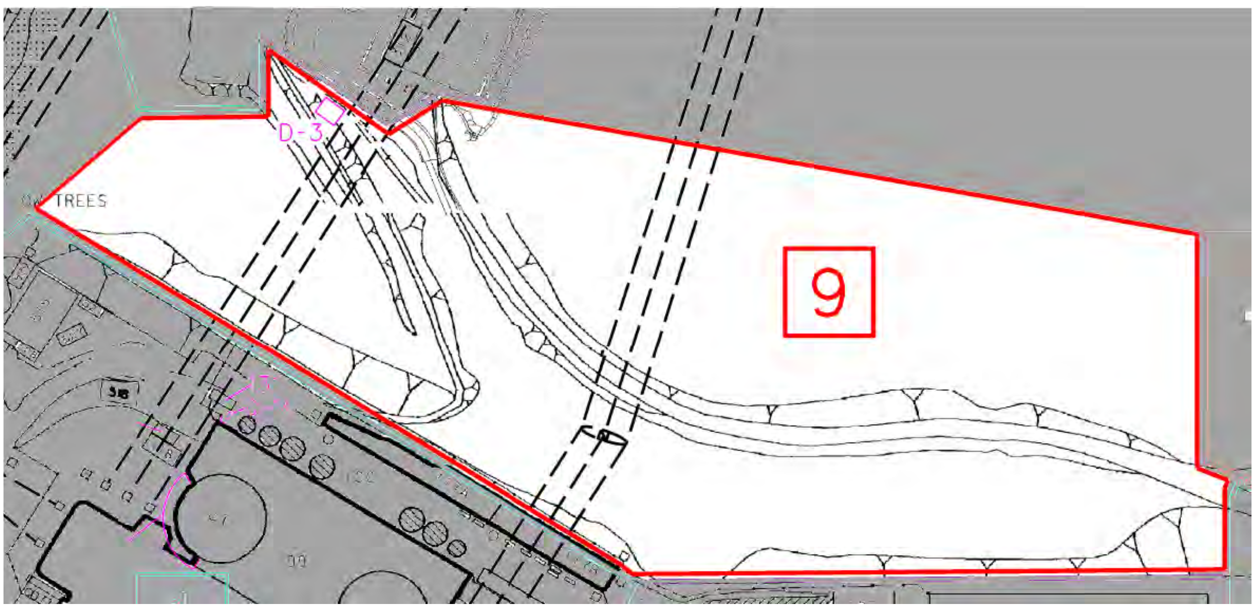
In keeping with efficient demolition work practices and good housekeeping objectives, the demolition debris will be moved away from the active demolition area in a safe and expeditious manner to reduce

interferences. Once removed away from the active demolition area, the demolition debris will be segregated by materials (i.e., structural steel, concrete rubble, general debris, etc.) to the greatest extent practicable and then loaded onto a transport vehicle and moved to the waste processing area for further dispositioning. The area will then be turned over to the Final Site Restoration scope of work (see Section 4.1.3.1) for performance of final site survey, backfill, and landscaping activities.

4.1.3.2.9. Building Demolition Zone 9

Zone 9 consists of an area outside and directly east of the main PA and includes the hillside area directly east of the plant. This area is east of Zones 1 and 3. None of the structures in Zone 9 are inside the RCA. See Figure 4-73 for relative location of the Site Overlook Facility within Zone 9. The only permanent plant structure within Zone 9 to be demolished is the Site Overlook Facility (Bldg. D-03).

Figure 4-73: Zone 9 Building



The Site Overlook Facility is a steel-constructed structure with deep piles. The structure is used to facilitate site tours and provide an overlook of the main DCPP power block structures. There are no contaminated areas or hazardous materials stored in this structure. Because the Site Overlook Facility is not unique in how it was built or what it contains, it is not classified as a heavy industrial demolition project. Building demolition scope for this structure consists of complete demolition and removal of all structures above grade and removal of the foundations to 3' below grade.

Schedule

The following activities will be performed to prepare the Zone 9 structure for demolition:

- A pre-demolition engineering report required by Standard Number 1926.850(a) of Chapter 29 of the Code of Federal Regulations, Subpart T, will be prepared.

- All known hazardous and/or regulated materials will be removed from the structure.
- All system equipment, piping, components, electrical switchgear, etc., designated for removal have been removed from the interior confines of the structure.
- All remaining equipment, piping, components, etc., will be drained, purged, and air gapped.
- The structure will be in a "cold-and-dark" condition prior to the onset of demolition activities.
- Radiation protection personnel will survey and release the structure for demolition to Open Air Demolition criteria.
- If required by the work plans, a dust suppression system such as either a "water mister" or other similar technology and supporting HEPA filters will be installed, along with all required temporary power and water supplies.

The Site Overlook Facility (the only structure in this zone) has no specific requirements or project uses and will be removed in accordance with the project schedule. Its removal has been scheduled to minimize mobilization and demobilization costs of a demolition contractor, as well as levelized waste streams and disposal costs.

Methodologies and Techniques

The demolition and removal of the Zone 9 structure can be performed by a standard industrial demolition team, using standard demolition techniques including, but not limited to, the following types of equipment:

- Hydraulic hoe-rams
- Hydraulic shears
- Concrete pulverizers
- Universal processors
- Articulated wheel load grapples, track-mounted backhoe grapples, and track-mounted backhoe "thumbs"
- On-site trucks

The ground adjacent to the foundation that requires removal will be sloped or benched in accordance with standard construction criteria (CalOSHA) to prevent excavation instability, and ramps will be excavated in strategic locations so that demolition and debris removal equipment (backhoes and dump trucks) can access the area as needed.

In keeping with efficient demolition work practices and good housekeeping objectives, the demolition debris will be moved away from the active demolition area in a safe and expeditious manner to reduce interferences. Once removed away from the active demolition area, the demolition debris will be segregated by materials (i.e., structural steel, concrete rubble, general debris, etc.) to the greatest extent practicable and then loaded onto a transport vehicle and moved to the waste processing area for further dispositioning. The area will then be turned over to the Final Site Restoration scope of work (see Section 4.1.3.1) for performance of final site survey, backfill, and landscaping activities.

4.1.3.2.10. Building Demolition Zone 10

Zone 10 consists of an area outside the main PA to the east of the main plant. This area contains the raw water reservoirs and ISFSI area and is located east of Zone 9. None of the structures in Zone 10 are inside the RCA. See Figure 4-74 for relative locations of the plant buildings within Zone 10.

Figure 4-74: Zone 10 Buildings

The following is a detailed list and description of permanent plant structures and facilities within Zone 10 to be demolished:

- Raw Water Reservoirs (Bldgs. 1A and 1B) – Serve as water reservoirs during plant operations to support plant makeup, domestic water, and fire water needs. Each pond is oval shaped below grade and is approximately 260 ft. x 180 ft. by 13 ft. deep. There are no contaminated areas or hazardous materials stored in these reservoirs.

- Makeup Water Office (Bldg. NPG049) – Serves as offices at the makeup water treatment facility. This pre-fabricated metal building is 24 ft. by 24 ft. by 12 ft. tall and rests on a slab with perimeter footings. There are no contaminated areas or hazardous materials stored in this building.
- Chlorination and Domestic Water Building (Bldg. 304) – Serves as a control room and chemical labs to provide chlorination of domestic water. This metal building is 28 ft. by 32 ft. by 14 ft. tall and rests on a slab with perimeter footings. There are no contaminated areas; however, hazardous materials have been used and stored in this building.
- Clarifier and Make-up Pre-treatment Building (Bldg. 305) – Serves as a pre-treatment facility to provide chlorination of domestic water. This metal building is 20 ft. by 24 ft. by 14 ft. tall and rests on a slab with perimeter footings. There are no contaminated areas; however, hazardous materials have been used and stored in this building.
- Chemical Storage (Bldg. 306) – Serves as a storage building for chemicals used in the treatment of domestic water. This metal building is 20 ft. by 24 ft. by 14 ft. tall and rests on a slab with perimeter footings. There are no contaminated areas; however, hazardous materials have been used and stored in this building.
- Wastewater Holding and Treatment Facility Equipment Enclosure (Bldg. 307) – This facility provides holding tanks and equipment for the processing of oily water and is used in a backup capacity only. It consists of a 40 ft. by 64 ft. by 14 ft. tall pre-fabricated sheet metal building that rests on a slab with perimeter and column footings, three 35 ft. diameter by 20 ft. tall tanks, and various supporting equipment. There are no contaminated areas; however, hazardous materials have been used and stored in this facility and some chemical remediation is expected.
- Long Term Cooling Water Pump Storage (Bldg. D-04) – Serves as a small storage building for a portable pump and fuel tank. This metal building rests on a slab and is 12 ft. by 12 ft. by 10 ft. tall. There are no contaminated areas; however, diesel fuel was stored in this building.

It is important to note that the ISFSI facility and any related support structures are not within the scope of Building Demolition, since they will be required to stay in service until all used fuel is transferred off-site. These facilities will be removed as part of ISFSI Final Site Restoration efforts (see Section 4.1.2.2.4 for details).

The Zone 10 buildings are standard concrete or metal buildings/structures built on slabs with minimal footings (perimeter and column). The internal structure environments for Buildings 1A, 1B, and NPG049 are either clean water reservoirs or typical office buildings that do not contain hazardous materials. Buildings 304, 305, 306, 307, and D-04 all stored or used hazardous materials; therefore, some remediation is expected, which will be performed prior to building demolition, as discussed below. There are no radiologically contaminated materials stored in any of these facilities. Because these buildings are not unique in how they were built or what they contain, the buildings in Zone 10 are not classified as heavy industrial demolition projects. Building demolition scope for these facilities consists of complete demolition and removal of all structures above grade and removal of all or some foundations. A study performed by PG&E to evaluate the extent of foundation removal for each structure recommends the following:

- Raw Water Reservoirs (Bldgs. 1A and 1B) – full removal of all foundations
- Make-up Water Office (Bldg. NPG049) – full removal of all foundations
- Chlorination and Domestic Water Building (Bldg. 304) – full removal of all foundations
- Clarifier and Make-up Pre-treatment Building (Bldg. 305) – full removal of all foundations
- Chemical Storage (Bldg. 306) – full removal of all foundations
- Wastewater Holding and Treatment Equipment Enclosure (Bldg. 307) – 3' below grade
- Long Term Cooling Water Pump Storage (Bldg. D-04) – full removal of all foundations

Schedule

The following activities will be performed to prepare the Zone 10 structures for demolition:

- A pre-demolition engineering report required by Standard Number 1926.850(a) of Chapter 29 of the Code of Federal Regulations, Subpart T, will be prepared.
- All known hazardous and/or regulated materials will be removed from the structures.
- All system equipment, piping, components, electrical switchgear, etc., designated for removal have been removed from the interior confines of the structures.
- All remaining equipment, piping, components, etc., will be drained, purged, and air gapped.
- The structures will be in a "cold-and-dark" condition prior to the onset of demolition activities.
- Radiation protection personnel will survey and release the structure for demolition to Open Air Demolition criteria.
- If required by the work plans, a dust suppression system such as either a "water mister" or other similar technology and supporting HEPA filters will be installed, along with all required temporary power and water supplies.

Raw Water Reservoir 1B is required to be demolished to support installation of the new security building for the ISFSI facility; it has been scheduled early in the project to allow time for this structure to be built (see Section 4.1.1.2.2).

Raw Water Reservoir 1A, the Chlorination and Domestic Water Building, Clarifier and Make-up Pre-treatment Building, Chemical Storage Building, and Make-up Water Office support the operation of the Sea Water Reverse Osmosis system; they are required to remain in service as long as possible to support the project's water needs, including Final Site Restoration activities. As a result, these facilities are scheduled to be removed as late as possible (see Section 4.1.3.1). The remaining buildings and structures in this zone (i.e., the Wastewater Holding and Treatment Equipment Enclosure and the Long-Term Cooling Water Pump Storage buildings) have no specific requirements or project uses and will be removed in accordance with the project schedule. Their removal has been scheduled to minimize mobilization and demobilization costs of a demolition contractor, as well as levelized waste streams and disposal costs.

Methodologies and Techniques

The demolition and removal of all Zone 10 structures can be performed by a standard industrial demolition team, using standard demolition techniques including, but not limited to, the following types of equipment:

- Hydraulic hoe-rams
- Hydraulic shears
- Concrete pulverizers
- Universal processors
- Articulated wheel load grapples, track-mounted backhoe grapples, and track-mounted backhoe "thumbs"
- On-site trucks

For larger structures such as the Wastewater Holding and Treatment Equipment Enclosure, the demolition will advance from the top down on a column bay by column bay basis (e.g., demolish everything between column line A to column line B, column line B to column line C, etc.)

The ground adjacent to the foundations that require removal will be sloped or benched in accordance with standard construction criteria (CalOSHA) to prevent excavation instability, and ramps will be excavated in strategic locations so that demolition and debris removal equipment (backhoes and dump trucks) can access the area as needed.

In keeping with efficient demolition work practices and good housekeeping objectives, the demolition debris will be moved away from the active demolition area in a safe and expeditious manner to reduce interferences. Once removed away from the active demolition area, the demolition debris will be segregated by materials (i.e., structural steel, concrete rubble, general debris, etc.) to the greatest extent practicable and then loaded onto a transport vehicle and moved to the waste processing area for further dispositioning. The area will then be turned over to the Final Site Restoration scope of work (see Section 4.1.3.1) for performance of final site survey, backfill, and landscaping activities.

4.1.3.2.11. Building Demolition Zone 11

Zone 11 consists of an area outside the main PA to the east of the main plant, within the canyon. This area contains the 230-kV and 500-kV switchyards and surrounding facilities and is located east of Zone 10. None of the structures in Zone 11 are inside the RCA. See Figure 4-75 for relative locations of the plant buildings within Zone 11.

Figure 4-75: Zone 11 Buildings

The following is a detailed list and description of permanent plant structures and facilities within Zone 11 to be demolished:

- Secondary Flex Equipment Storage Facility (Bldg. 313) – Serves as a storage pad for backup portable equipment required during operation of the plant. This structure is a 60 ft. by 200 ft. by 8-inch thick concrete slab on grade with 2 ft. deep perimeter footings, and six 8 ft. by 40 ft. by 8 ft. tall seatrains for storage. Large trailer-mounted equipment was anchored to this pad, and support equipment is stored in sea trains. There are no contaminated areas, and no hazardous materials were stored on this pad or associated sea trains.

- GC Electric Yard Storage (Bldg. GC075) – Serves as a storage area for equipment and construction offices. This structure is 40 ft. by 40 ft. by 10 ft. tall and consists of three sea trains with a wooden shed-like structure in between. There are no contaminated areas or hazardous materials stored in this building.
- ISFSI Office Trailer (Bldg. NPG226) – Serves as an office area for individuals associated with the DC ISFSI construction. This modular building is 16 ft. by 40 ft. by 12 ft. tall. There are no contaminated areas or hazardous materials stored in this building.
- B-Gate Office (Bldg. D-6) – Serves as a construction office and storage area. This timber construction facility is 16 ft. by 25 ft. by 10 ft. tall. There are no contaminated areas or hazardous materials stored in this building.
- B-Gate Shade Structure (Bldg. D-7) – Serves as a covered equipment storage area. This is a 20 ft. by 120 ft. by 12 ft. tall overhead roof structure on a concrete slab with perimeter footings. There are no contaminated areas or hazardous materials stored in this building.
- Scaffold Storage Yard (Bldg. D-5) – Serves as construction offices and a scaffold materials storage area. This structure is 60 ft. by 80 ft. by 10 ft. tall and consists of a small modular office and multiple sea trains with a wooden shed-like structure in between resting on a slab. There are no contaminated areas or hazardous materials stored in this building.

The 230-kV and 500-kV switchyards are not within the scope of Building Demolition. These facilities will be removed as part of Final Site Restoration efforts (see Sections 4.1.2.2.4 and 4.1.3.1.4 for details).

The Zone 11 buildings are standard metal or modular buildings/structures built on slabs. The internal structure environments are either typical office buildings, storage facilities, or workshops and do not contain hazardous materials. Because these buildings are not unique in how they were built or what they contain, the buildings in Zone 11 are not classified as heavy industrial demolition projects. Building demolition scope for these facilities consists of complete demolition and removal of all structures above grade and removal of all foundations.

Schedule

The following activities will be performed to prepare the Zone 11 structures for demolition:

- A pre-demolition engineering report required by Standard Number 1926.850(a) of Chapter 29 of the Code of Federal Regulations, Subpart T, will be prepared.
- All known hazardous and/or regulated materials will be removed from the structures.
- All system equipment, piping, components, electrical switchgear, etc., designated for removal have been removed from the interior confines of the structures.
- All remaining equipment, piping, components, etc., will be drained, purged, and air gapped.
- The structures will be in a “cold-and-dark” condition prior to the onset of demolition activities.

- Radiation protection personnel will survey and release the structure for demolition to Open Air Demolition criteria.
- If required by the work plans, a dust suppression system such as either a "water mister" or other similar technology and supporting HEPA filters will be installed, along with all required temporary power and water supplies.

The Secondary Flex Equipment Storage Facility may be required to house backup equipment while fuel is stored in the SFP. For this reason, it is currently scheduled to be demolished after the spent fuel and GTCC waste have been relocated to the ISFSI.

The remaining buildings and structures in this zone have no specific requirements or project uses and will be removed in accordance with the project schedule. Their removal has been scheduled to minimize mobilization and demobilization costs of a demolition contractor, as well as levelized waste streams and disposal costs.

Methodologies and Techniques

The demolition and removal of all Zone 11 structures can be performed by a standard industrial demolition team, using standard demolition techniques including, but not limited to, the following types of equipment:

- Hydraulic hoe-rams
- Hydraulic shears
- Concrete pulverizers
- Universal processors
- Articulated wheel load grapples, track-mounted backhoe grapples, and track-mounted backhoe "thumbs"
- On-site trucks

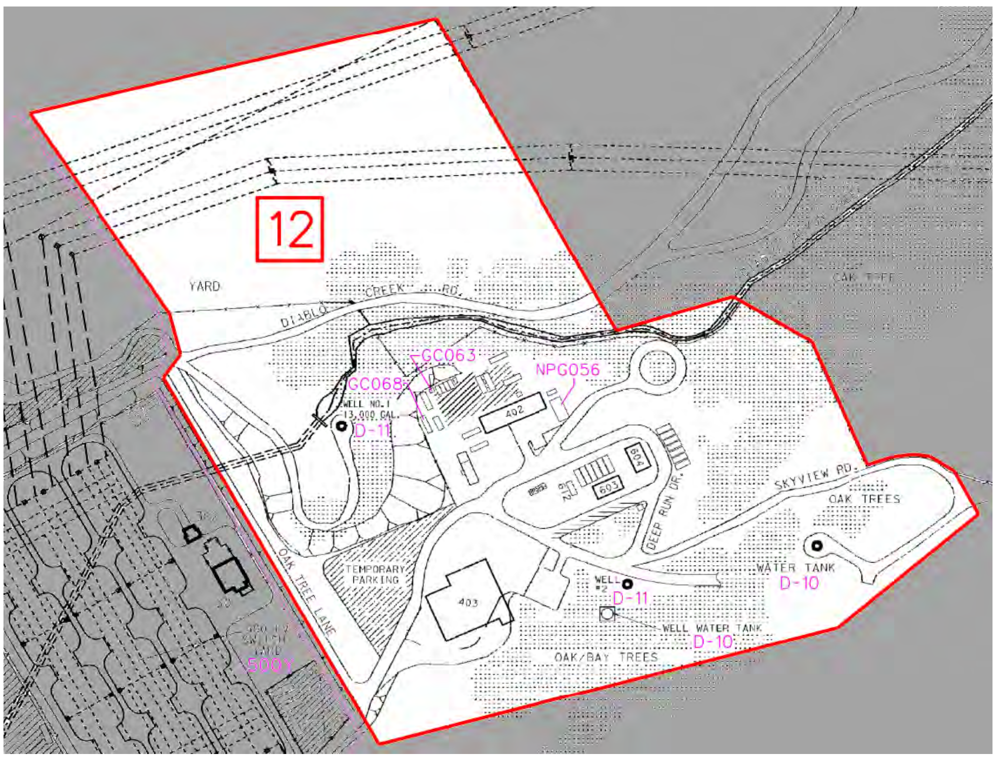
The ground adjacent to the foundations that require removal will be sloped or benched in accordance with standard construction criteria (CalOSHA) to prevent excavation instability, and ramps will be excavated in strategic locations so that demolition and debris removal equipment (backhoes and dump trucks) can access the area as needed.

In keeping with efficient demolition work practices and good housekeeping objectives, the demolition debris will be moved away from the active demolition area in a safe and expeditious manner to reduce interferences. Once removed away from the active demolition area, the demolition debris will be segregated by materials (i.e., structural steel, concrete rubble, general debris, etc.) to the greatest extent practicable and then loaded onto a transport vehicle and moved to the waste processing area for further dispositioning. The area will then be turned over to the Final Site Restoration scope of work (see Section 4.1.3.1) for performance of final site survey, backfill, and landscaping activities.

4.1.3.2.12. Building Demolition Zone 12

Zone 12 consists of an area outside the main PA to the east of the main plant, within the canyon. This area is located east of Zone 11 and contains miscellaneous support structures and facilities located at the far eastern end of DCPP. None of the structures in Zone 12 are inside the RCA; however, the OSGSF (Bldg. 403) is considered a radiation area since it contains internally contaminated, retired equipment that was removed from service during plant operations. See Figure 4-76 for relative locations of the plant buildings within Zone 12.

Figure 4-76: Zone 12 Buildings



The following is a detailed list of permanent plant structures and facilities within Zone 12 to be demolished:

- Vehicle Maintenance Shop (Bldg. 402) – Serves as the vehicle maintenance workshop for the DCPP site. This metal building is 40 ft. by 64 ft. by 15 ft. tall and rests on a slab with perimeter and column footings. There are no contaminated areas in this building, but it does store hazardous materials.
- Old SG Storage Facility (Bldg. 403) – Serves as a storage building for plant equipment that was removed and replaced during operations, including the old SGs and the old reactor vessel closure heads. This concrete building is 146 ft. by 138 ft. by 28 ft. tall and contains deep piles

that extend up to 60’ below grade. There are no hazardous materials stored in this building; however, because internally contaminated, retired equipment is stored within the building, there is a potential for the building to be contaminated.

- Document Storage (Bldg. 603) – Serves as a storage building. This concrete block building is 31 ft. by 78 ft. by 12 ft. tall and rests on a slab with perimeter and column footings. There are no contaminated areas or hazardous materials stored in this building.
- Project Files Storage (Bldg. 604) – Serves as a storage building. This metal building is 41 ft. by 60 ft. by 14 ft. tall and rests on a slab with perimeter footings. There are no contaminated areas or hazardous materials stored in this building.
- Toilet Trailer (Bldg. 612) – Serves as a restroom facility for this area. This modular building is 8 ft. by 60 ft. by 12 ft. tall. There are no contaminated areas or hazardous materials stored in this building.
- Vehicle Maintenance Office (Bldg. NPG056) – Serves as an office facility for the vehicle maintenance shop personnel. This modular building is 8 ft. by 40 ft. by 10 ft. tall. There are no contaminated areas or hazardous materials stored in this building.
- Laborer Break Room (Bldg. GC063) – Serves as a construction facility break room. This timber building is 8 ft. by 8 ft. by 8 ft. tall. There are no contaminated areas or hazardous materials stored in this building.
- Laborer Break Room (Bldg. GC068) – Serves as a construction facility break room. This modular building is 8 ft. by 16 ft. by 8 ft. tall. There are no contaminated areas or hazardous materials stored in this building.
- Fleet Services Break Trailer (Bldg. NPG091) – Serves as a break room facility for vehicle maintenance shop personnel. This modular building is 8 ft. by 40 ft. by 10 ft. tall. There are no contaminated areas or hazardous materials stored in this building.

The Zone 12 buildings are standard concrete, metal, or modular buildings built on slabs with minimal or no footings (perimeter and column). The internal structure environments are either typical office buildings, storage facilities, or workshops. Because these buildings are not unique in how they were built or what they contain, the buildings in Zone 12 are not classified as heavy industrial demolition projects. Building demolition scope for these facilities consists of complete demolition and removal of all structures above grade and removal of all or some foundations. A study performed by PG&E to evaluate the extent of foundation removal for each structure recommends that all foundations be fully removed for Zone 12 structures, except for the OSGSF. The OSGSF foundation will be removed to 3’ below grade.

Schedule

The following activities will be performed to prepare the Zone 12 structures for demolition:

- A pre-demolition engineering report required by Standard Number 1926.850(a) of Chapter 29 of the Code of Federal Regulations, Subpart T, will be prepared.
- All known hazardous and/or regulated materials will be removed from the structures.

- All system equipment, piping, components, electrical switchgear, etc., designated for removal have been removed from the interior confines of the structures.
- All remaining equipment, piping, components, etc., will be drained, purged, and air gapped.
- The structures will be in a "cold-and-dark" condition prior to the onset of demolition activities.
- Radiation protection personnel will survey and release the structure for demolition to Open Air Demolition criteria.
- If required by the work plans, a dust suppression system such as either a "water mister" or other similar technology and supporting HEPA filters will be installed, along with all required temporary power and water supplies.

Demolition of the OSGSF cannot occur until after the legacy components stored in it have been removed and dispositioned. Therefore, this building is not scheduled to be demolished until after these components have been removed (see Section 4.1.1.6).

The remaining buildings and structures in this zone have no specific requirements or project uses and will be removed in accordance with the project schedule. Their removal has been scheduled to minimize mobilization and demobilization costs of a demolition contractor, as well as levelized waste streams and disposal costs.

Methodologies and Techniques

The demolition and removal of all Zone 12 structures can be performed by a standard industrial demolition team, using standard demolition techniques including, but not limited to, the following types of equipment:

- Hydraulic hoe-rams
- Hydraulic shears
- Concrete pulverizers
- Universal processors
- Articulated wheel load grapples, track-mounted backhoe grapples, and track-mounted backhoe "thumbs"
- On-site trucks

For larger structures such as the OSGSF, the demolition will advance from the top down on a column bay by column bay basis (e.g., demolish everything between column line A to column line B, column line B to column line C, etc.)

The ground adjacent to the foundations that require removal will be sloped or benched in accordance with standard construction criteria (CalOSHA) to prevent excavation instability, and ramps will be excavated in strategic locations so that demolition and debris removal equipment (backhoes and dump trucks) can access the area as needed.

In keeping with efficient demolition work practices and good housekeeping objectives, the demolition debris will be moved away from the active demolition area in a safe and expeditious manner to reduce interferences. Once removed away from the active demolition area, the demolition debris will be segregated by materials (i.e., structural steel, concrete rubble, general debris, etc.) to the greatest extent practicable and then loaded onto a transport vehicle and moved to the waste processing area for further dispositioning. The area will then be turned over to the Final Site Restoration scope of work (see Section 4.1.3.1) for performance of final site survey, backfill, and landscaping activities.

4.1.3.2.13. Building Demolition Zone 13

Zone 13 consists of the remainder of the owner-controlled area that is not included in Zones 1 through 12. For this reason, a map of buildings and facilities located in Zone 13 is not provided. It includes facilities located in areas outside of Zones 1-12, as well as any larger facility or items that fall within multiple zones (for example, the circulating water tunnels). None of the structures in Zone 13 are inside the RCA. The following is a detailed list of permanent plant structures and facilities included in Zone 13:

- Avila Gate Guard House (Bldg. 601) – Serves as one of two buildings that are used to support screening personnel and visitors for entry onto the PG&E property and is located at the Avila Gate, near the entrance to the plant at Harford Drive. This steel and timber construction building is 6 ft. by 12 ft. by 10 ft. tall and is on shallow pier footings. There are no contaminated areas or hazardous materials stored in this building. A photo of the Avila Gate area is shown in Figure 4-77.
- Avila Gate Guard House (Bldg. 602) – Serves as one of two buildings that are used to support screening personnel and visitors for entry onto the PG&E property and is located at the Avila Gate, near the entrance to the plant at Harford Drive. This timber construction building is 16 ft. by 23 ft. by 12 ft. tall and rests on a slab with perimeter footings. There are no contaminated areas or hazardous materials stored in this building. A photo of the Avila Gate area is shown in Figure 4-77.
- Underground Septic Tanks and Pump Stations (Bldg. D-9) – Various tanks and underground pumps that support the on-site sewage system. There are no radiological contaminated areas in this structure; however, these structures will most likely require chemical decontamination and cleaning prior to demolition.
- Above Ground Water Tanks (Bldg. D-10) – Serve as the main domestic and make-up water storage tanks on the DCPP site. These three steel tanks are 100,000-gallon, 15,000-gallon, and 10,000-gallon capacity, and rest on slabs with perimeter footings. There are no contaminated areas or hazardous materials stored in these tanks.
- Water Wells (Bldg. D-11) –Two separate wells serve to provide water to the make-up water system. These water wells extend up to 350’ below grade. There are no contaminated areas or hazardous materials stored in this structure.
- Security Structures – Blast and Bullet Resistant Enclosures (BBRE's) and Crash Gates (Bldg. D-15) – These items serve as security features to support the current security plan. There are six

BBRE's; all of which are steel structures with enclosures on top. They are all 9 ft. by 12 ft. and range in height from 40 ft. to 65 ft. tall. Five of the structures are installed on deep piles, and one is on a large slab. Three security "crash gates" also are included in this item at Gates 1, 20 and the "North Gate" location at the northwest corner of the main PA where the road crosses Diablo Creek. These gates are large movable steel structures that are cast into approximately 1 ft. thick concrete slabs on grade. There are no contaminated areas or hazardous materials stored in on or within these structures.

- Circulating Water Tunnels, Units 1 and 2 (Bldg. D-17) – These two sets of underground tunnels are used to transfer ocean water from the Intake Structure to the Turbine Building, through the main condensers, then out to the Discharge Structure. The Intake Tunnels run from the Intake Structure to the Turbine Building, and the Discharge Tunnels run from the Turbine Building to the Discharge Structure. These tunnels are included in Zones 1, 4, and 5. There are two Intake tunnels per unit and two Discharge Tunnels per unit, for a total of eight tunnels. Each of these tunnels is approximately 10 ft. by 10 ft. square on the inside, with approximately 3 ft. thick concrete on all four sides. Each unit's Intake Tunnels are joined together for about 75 percent of their length and share a common wall. The approximate length of the Intake Tunnels is 1,500 ft. for Unit 1 and 1,300 ft. for Unit 2. The approximate length of the Discharge Tunnels for both units is approximately 300 ft. long. All four Intake Tunnels and all four Discharge Tunnels are located more than 3 ft. below local grade elevations. There are no contaminated areas or hazardous materials stored in the tunnels. Photos of the tunnels during original construction are found in Figure 4-78 and Figure 4-79.

Figure 4-77: Avila Gate Guard House

Figure 4-78: Unit 1 Intake Tunnels

Figure 4-79: Unit 1 and 2 Discharge Tunnels

Due to their construction, the buildings in Zone 13 are not classified as heavy industrial demolition projects. With the exception of the Circulating Water Tunnels (see below), building demolition scope for these facilities consists of complete demolition and removal of all structures above grade, and removal of all or some foundations. A study performed by PG&E to evaluate the extent of foundation removal for each structure recommends the following:

- Avila Gate Guard House (Bldg. 601) – fully remove foundation
- Avila Gate Guard House (Bldg. 602) – fully remove foundation
- Underground Septic Tanks and Pump Stations (Bldg. D-9) – fully remove foundation
- Above Ground Water Tanks (Bldg. D-10) – 3’ below grade
- Water Wells (Bldg. D-11) – remove 3’ below grade
- Security Structures - BBRE's and Crash Gates (Bldg. D-15) – 3’ below grade
- Circulating Water Tunnels, Units 1 and 2 (Bldg. D-17) – remove localized roof sections for access, then backfill tunnels with soil/crushed concrete and leave in place. As discussed above, all tunnels are deeper than 3' below local grade.

The scope of work associated with Building Demolition for the Circulating Water Tunnels is limited to the installation of structural bulkheads at each end of all the Intake and Discharge Tunnels. These bulkheads will seal the ends of the tunnels, which will be backfilled later by the Final Site Restoration scope of work (see Section 4.1.3.1).

Schedule

The following activities will be performed to prepare the Zone 13 structures for demolition:

- A pre-demolition engineering report required by Standard Number 1926.850(a) of Chapter 29 of the Code of Federal Regulations, Subpart T, will be prepared.
- All known hazardous and/or regulated materials will be removed from the structures.
- All system equipment, piping, components, electrical switchgear, etc., designated for removal have been removed from the interior confines of the structures.
- All remaining equipment, piping, components, etc., will be drained, purged, and air gapped.
- The structures will be in a “cold-and-dark” condition prior to the onset of demolition activities.
- Radiation protection personnel will survey and release the structure for demolition to Open Air Demolition criteria.
- If required by the work plans, a dust suppression system such as either a “water mister” or other similar technology and supporting HEPA filters will be installed, along with all required temporary power and water supplies.

The Security Structures - BBRE's and Crash Gates contain equipment that is required to support the security plan and will be demolished after the spent fuel and GTCC waste have been relocated to the ISFSI and the PA removed.

The Circulating Water Tunnels, Units 1 and 2, serve no specific operational or project uses after the units are shutdown, and the bulkheads will be installed in accordance with the project schedule.

The remaining buildings and structures in this zone have no specific requirements or project uses and will be removed in accordance with the project schedule. Their removal has been scheduled to minimize mobilization and demobilization costs of a demolition contractor, as well as levelized waste streams and disposal costs.

Methodologies and Techniques

The demolition and removal of all Zone 13 structures with the exception of the Circulating Water Tunnels can be performed by a standard industrial demolition team, using standard demolition techniques including, but not limited to, the following types of equipment:

- Hydraulic hoe-rams
- Hydraulic shears
- Concrete pulverizers
- Universal processors
- Articulated wheel load grapples, track-mounted backhoe grapples, and track-mounted backhoe “thumbs”
- On-site trucks

For larger structures such as the security structures, the demolition will advance from the top down on a column bay by column bay basis (e.g., demolish everything between column line A to column line B, column line B to column line C, etc.).

The ground adjacent to the foundations that require removal will be sloped or benched in accordance with standard construction criteria (CalOSHA) to prevent excavation instability, and ramps will be excavated in strategic locations so that demolition and debris removal equipment (backhoes and dump trucks) can access the area as needed.

In keeping with efficient demolition work practices and good housekeeping objectives, the demolition debris will be moved away from the active demolition area in a safe and expeditious manner to reduce interferences. Once removed away from the active demolition area, the demolition debris will be segregated by materials (i.e., structural steel, concrete rubble, general debris, etc.) to the greatest extent practicable and then loaded onto a transport vehicle and moved to the waste processing area for further dispositioning. The area will then be turned over to the Final Site Restoration scope of work (see Section 4.1.3.1) for performance of final site survey, backfill, and landscaping activities.

4.1.3.3. Waste Management, Transportation, and Burial

4.1.3.3.1. Waste and Transportation Management

The Waste Management and Transportation organization has responsibilities in all three phases of decommissioning: license termination, site restoration, and spent fuel management. While the source of the waste may be different in the three phases, the responsibilities and methods for the group are the same. The details of Waste and Transportation Management are in Section 4.1.1.7.1. Decommissioning activities that are occurring during this phase are major building demolition, Breakwater removal, and site restoration.

The total cost of Waste Transportation and Disposal during the site restoration phase is provided in Table 4-1.

4.1.3.3.2. Solid Radioactive Waste

Solid radioactive waste transportation and disposal is off-site shipment and final burial of solid radioactive waste from the DCPP site. This activity starts when the waste has been loaded on a transport truck and ends when it is disposed of at the disposal site. Compared to other phases of work, the source of the waste and quantities may be different, but how the waste is classified and disposed of is the same. The details of solid radioactive waste are in Section 4.1.1.7.2. Solid radioactive waste during this phase will be a combination of concrete and steel originating from building demolition.

4.1.3.3.3. Liquid Radioactive Waste

There is currently no liquid radioactive waste estimated for off-site transportation, processing, and disposal during site restoration. While the source and quantities of the waste may be different in the three phases, how the waste is classified, transported, processed, and disposed of is the same. The details of liquid radioactive waste are in Section 4.1.1.7.3.

4.1.3.3.4. Hazardous and/or Regulated Material

Hazardous waste transportation and disposal is the off-site shipment and final burial of hazardous waste from the DCPP site. This activity starts when the waste is placed on a transport truck and ends when it is disposed of at the disposal site. How the waste is classified, transported, processed, and disposed of is the same regardless of when it occurs. The details of hazardous waste are in Section 4.1.1.7.4. During this phase of work, hazardous material will be mainly focused on contaminated soils remediation.

4.1.3.3.5. Non-detectable Material (Clean Waste)

During site restoration there will be activities that generate clean waste. How the waste is classified, processed, and disposed of is the same regardless of when it occurs. The details of clean waste are in Section 4.1.1.7.5. During this phase of work the clean waste streams are from both the building demolition and site restoration activities. Clean materials include but are not limited to, concrete (Breakwater and buildings), soils, and metals.

4.1.3.4. Materials Management

4.1.3.4.1. Materials Program Management

During site restoration activities, there are materials that will qualify for either reuse on site or recycling that are under the purview of Materials Management. Compared to other phases, the source and quantities of the assets and commodities may be different, but how the items are classified, resold, repurposed, or recycled is the same. The details of Material Management are in Section 4.1.1.8.1. For the Site Restoration phase of work, Material Management will be focused on the off-site recycling/disposal and onsite repurposing of concrete rubble.

The cost of materials management during the site restoration phase is provided in Table 4-1.

4.1.3.5. Support Services

4.1.3.5.1. Project Management

The DCPP Decommissioning management staff is responsible for ensuring development and implementation of decommissioning budgets, plans, and schedules that result in the safe and cost-effective decommissioning and restoration of the DCPP site. The management team has responsibilities in all three phases of decommissioning: license termination, site restoration, and spent fuel management. The details of Project Management ramp-up and ramp-down are in Section 4.1.1.9.1.

PG&E will begin some site restoration activities upon Unit 2 shutdown. Site restoration is the phase where the site is restored to its final configuration and includes:

- Building demolition
- Deep excavations
- Balance of site restoration
- Waste management, transportation, and burial
- Materials management
- Support needs

Those activities will be of limited scope initially and will require minimal oversight and support resources. Because the management team is required for license termination activities, no costs for management activities will be accrued towards site restoration until after systems removal; however, early Project Management activities may include releasing and demolishing peripheral buildings and surveying and remediating areas beyond the plant footprint. Those Project Management activities are costed in the discrete scopes of work. As decommissioning proceeds, site restoration activity levels will increase as the license termination work ends. The groups involved with site restoration include Executive Management, Project Controls, Engineering, Maintenance, RP, and Safety. The time each group will dedicate to site restoration is estimated at:

- 50 percent from systems removal to license termination

- After license termination, the groups will split their time between fuel management and site restoration

Executive management plays a key role in setting policy, acquiring funding, approving budgets and schedules, and interfacing with stakeholders on site restoration issues. Security management oversees the security forces that control access to the site and will be controlling the flow of waste transporters on and off the site. RP management oversees the surveying, classification, packaging, and transportation of wastes off-site. The Closure organization oversees the site restoration effort, infrastructure changes to support site restoration, and FSS.

The Project Management costs are those costs attributed to the management team as described in Section 4.1.1.9.1. The cost of Project Management staffing to support site restoration after completing systems removal is included in Support Services in Table 4-1.

4.1.3.5.2. Project Controls

Project Controls includes a wide array of accounting, cost control, and scheduling activities needed for the planning and execution of a large project such as the DCPP decommissioning. Decommissioning Support provides the expertise for Document Control and Records Management System (DC/RMS) while the mission of the Project Controls organization is to provide financial oversight of the decommissioning project, including tracking conformance with established budgets and schedules, maintaining financial records, preparing communications pertaining to the financial status of the decommissioning for state and federal regulators, and preparing and submitting required reports to regulatory agencies such as the NRC, CPUC, and DOE.

Project Controls has responsibilities in all three phases of decommissioning: license termination, site restoration, and spent fuel management. The details of Project Controls ramp-up and ramp-down are in Section 4.1.1.9.2.

The Project Controls activities will be billed to SFM when working on the DOE annual reports, ISFSI Assurance of Funding Letter, and any DOE litigation issues. After site restoration, any residual reporting and litigation responsibilities will be absorbed by the Security and Emergency Services organization. The total anticipated costs for Business Services SFM activities prior to completion of site restoration are included in Support Services in Table 4-1.

Initially, the Project Controls site restoration activities will be of limited scope and will require minimal oversight and support resources. As the decommissioning proceeds, the site restoration activity levels will increase as the license termination work concludes. The time that Project Controls will dedicate to site restoration is estimated at:

- 25 percent from systems removal to license termination
- 75 percent from license termination to completion of site restoration
- After site restoration any residual responsibilities will be transferred to the Security organization

The cost of Project Controls staffing to support site restoration is included in Support Services in Table 4-1.

4.1.3.5.3. Engineering

Engineering staff will be supporting a wide range of activities including the work planning efforts, PMP development, design change reviews, transition planning, ISFSI and security upgrades, and site restoration planning. Engineering has responsibilities in all three phases of decommissioning: license termination, site restoration, and spent fuel management. The details of Engineering ramp-up and ramp-down are in Section 4.1.1.9.3.

The site restoration activities for engineering are predominantly oversight of civil projects and waste. The cost of engineering staffing to support site restoration is included in Support Services in Table 4-1.

4.1.3.5.4. Operations

Operations personnel are responsible for monitoring and manipulating the mechanical and electrical systems at the plant. There are no site restoration activities that require operations support and, therefore, there are no Operations staffing costs attributable to site restoration.

4.1.3.5.5. Maintenance

Site Maintenance Support requires sufficient staff to respond to repair requests and keep the site in good working condition and maintained to a safe level. After license termination, the workload for Maintenance is appreciably reduced, and the staffing is ramped-down accordingly. The details of Maintenance ramp-up and ramp-down are in Section 4.1.1.9.5. After license termination, there will be a residual need for electrical and facilities maintenance support until building demolition is completed. Once that occurs, the remaining Maintenance staff will be released. The cost of Maintenance staffing to support site restoration is included in Support Services in Table 4-1.

4.1.3.5.6. Radiation Protection

Site restoration is the phase where the site is restored to its final configuration and includes:

- Building demolition
- Deep excavations
- Remaining site restoration
- Waste management, transportation, and burial
- Materials management
- Support needs

Those activities will consume minimal RP oversight and support resources. Early activities may include releasing and demolishing peripheral building and surveying and remediating areas beyond the plant footprint. As decommissioning proceeds, the site restoration activity levels will increase as the license termination work ends. The RP positions that will provide oversight and support of the site remediation efforts include count room and instrumentation technicians, dosimetry, plant chemistry for environmental sampling, and field oversight. The details of RP ramp-up and ramp-down are in Section 4.1.1.9.6.

The cost of RP staffing to support site restoration is included in Support Services in Table 4-1.

4.1.3.5.7. Final Status Survey

In order to terminate the 10 CFR 50 licenses in the license termination phase, the areas within the Part 50 license boundary must be systematically surveyed and records generated for submittal to the NRC. The degree of effort in the surveys varies from low in outlying areas to very high in the affected areas of the Part 50 license boundary. A systematic approach to conducting the surveys and generating the records starts with the development of a survey plan. The effort and resources to conduct, document, and obtain approval of the FSS are discussed in Section 4.1.1.9.7. Since an approved FSS is needed for license termination, the cost of FSS and LTP staffing are in Section 4.1.1.9.7. There are no FSS staffing costs attributable to site restoration.

4.1.3.5.8. Security

10 CFR Part 73 requires "…the establishment and maintenance of a physical protection system which will have capabilities for the protection of special nuclear material…" The details of the Security force efforts and ramp-up/ramp-down of staff are discussed in Section 4.1.1.9.8. There are no Security staffing costs attributable to site restoration.

4.1.3.5.9. Safety

The Safety organization is responsible for two main functions: overseeing implementation of the PG&E Safety Program and Fire Protection for the site. After the Zirc fire window closes, any fire protection or fire suppression needs will be provided under contract by a local mutual aid or fire department. Several safety professionals will be retained during the final stages of building demolition and site restoration to ensure that safety requirements are being met. The cost of Safety staffing to support site restoration is included in Support Services in Table 4-1.

4.1.3.5.10. Procedures

The current operating procedures may or may not meet the need for safe implementation of work at a shutdown facility. The ongoing procedure effort during license termination should have reduced the procedure sets that would require maintenance or revision to a manageable set that will require no additional resources. There are no expected costs of procedure writing or maintenance attributable to site restoration.

4.1.3.5.11. Training

The training workload during site restoration should be minimal and easily accomplished by existing resources. There are no expected additional costs of training attributable to site restoration.

4.1.3.5.12. Regulatory Management

Managing the interactions with regulatory agencies such as the NRC and the CCC are important to ensure that all parties have a common understanding, all requirements are met, and any issues are identified early and resolved before they create safety, schedule, or cost perturbations. Managing the interactions is a coordinated effort by personnel with expertise in licensing issues, permitting, legal, and emergency preparedness. The activities that pertain to SFM are those associated with the ISFSI Security Plan, ISFSI Emergency Preparedness Plan, and the 10 CFR Part 72 site-specific license for the ISFSI. The group that manages the regulatory interactions is also responsible for licensing, permits, and plans that pertain to the plant site and are not part of SFM. Prior to Unit 2 shutdown, all regulatory management costs are considered to be regular NDT or operations and maintenance costs. After Unit 2 shutdown, the costs of regulatory management will be attributed to site restoration and the other phases. The ratio will shift to 100 percent for SFM once the 10 CFR Part 50 licenses are terminated and site restoration is completed. The cost of regulatory management associated with site restoration is included in Support Services in Table 4-1.

4.1.3.5.13. Permit Preparation and Agency Reviews

In addition to the PG&E permitting team, contractors will assist in the accurate and timely preparation, processing, and completion of permit conditions that are critical to the start of execution activities and the completion of license termination. Contractor activities include data collection; the completion of environmental studies; development of a project description; development of application documentation; environmental impact assessments; the fulfilment of permit conditions; and conducting environmental compliance monitoring and reporting, depending on the permit. Costs associated with discretionary permit mitigations are currently unknown and will be determined as part of the permit application and CEQA processes. As a result, these costs are not included in the permitting cost estimates.

Applicable activities have been identified for each permit and the related costs for major discretionary and environmental permits are estimated based on a combination of benchmarking of similar projects, subject matter expertise, and experience.

In addition to these contractor labor costs, some agencies charge an agency review fee that is a labor-based fee depending on the amount of review time required by the agency to review and process the permit. These are not set fee amounts. Each estimated agency review rate has been determined for major discretionary and environmental permits through either published rates or benchmarking from previous reviews by the agency. Similarly, the anticipated agency review times were estimated by benchmarking similar permit reviews.

The permit contractor labor and agency review costs have been evaluated for applicable work scope covered in license termination, spent fuel management, and site restoration. Based on the assessment, one-third of the permitting contractor labor and agency review costs have been applied to site restoration.

4.1.3.5.14. Public Relations

Stakeholders have a vested interest in the safe, effective, and efficient completion of all decommissioning activities. Stakeholders include PG&E shareholders, employees, local community members, local government, state regulators, and federal regulators. Stakeholder interests range from continued employment opportunities to the radiological consequences of decommissioning activities to environmental impacts of previous plant operations and the site environmental end state condition.

Because PG&E has finalized the decision to decommission DCPP, it has formed the DCDEP, which will provide community input as PG&E prepares a site-specific plan to decommission the plant. Methods of communication with the panel may include routine meetings, letters, newsletters, joint public briefings, and an open-door policy with management. The cost of this effort will be attributed to license termination and not specifically to site restoration.

Feedback will be collected from the panel and agencies on future use of the DCPP lands, including reuse of existing structures and the possibility of new development consistent with existing County of San Luis Obispo Land Use Designations. Input from the DCDEP and agencies will be used to assist in evaluating land use alternatives, select a preferred alternative, and develop a long-term future land use plan.

Employees are impacted by the changes at the facility and the uncertainty of their jobs as decommissioning progresses. Human Resources (HR) support personnel who are familiar with PG&E's resources and policies will facilitate employee communications. HR will be able to address specific individual concerns raised by employees. The cost of the HR effort will be attributed to license termination and not specifically to site restoration.

Several key positions will facilitate the plethora of communication opportunities: employee communications, Governmental Relations, and Public Relations. The cost of these positions and the public relations effort will be attributed to license termination and not to site restoration.

4.1.3.5.15. Specialty Contracts

The specialty contracts scope encompasses maintenance of the site infrastructure that will accommodate the decommissioning team through the duration of the decommissioning project and general support to both PG&E and vendors performing their specific scopes of work. It is further detailed in Section 4.1.1.9.

The Special Contracts scope of the Site Restoration phase will begin after the FSS and the Part 50 licenses are terminated. During this phase it is expected that building demolition will be substantially completed and site restoration activities, such as grading, and seeding, will be in progress. At this time all decontamination activities will be completed, no plant equipment will be operating, and any remaining staff will be focused on demobilization from the site. This scope will provide a minimum of industrial security forces control access to the site; will provide garbage pick-up and janitorial services for the remaining decommissioning team; and will pay monthly utility charges, water management contract charges, and fuel used by the decommissioning program groups. Emergency Preparedness, Emergency Planning, and NRC fees will only be associated with fuel management as part of the transition from the termination of Part 50 licenses to a Part 72 site-specific license. However, property tax and property and liability Insurance will continue to be assessed until the end of site restoration.

Provisions for tools, equipment, supplies, and specialty contracts will be handled accordingly based on the contracting strategy. Vendors will plan and procure materials for their associated scope of work. PG&E self-performed scope activities are estimated and included in this section.

4.1.3.5.15.1. Facilities, Garbage, and Janitorial

Facilities

Tools, Equipment, and Supplies include:

- Tools, equipment, and supplies: General tools, equipment and supplies will be minimal and provided only for the programmatic personnel overseeing the final grading and seeding of the site.
- Specialty tools and equipment: Will no longer be required by the programmatic groups as all equipment and structures will have been removed.
- Health physics supplies/RP tools and equipment: Will only be required as part of SFM and not required in site restoration.
- Services, supplies and consumables: Recurring costs associated with essential services to support the decommissioning staffing organization include site operation and maintenance services, general office supplies, insurance costs, plant energy, property taxes, NRC fees, emergency planning fees, environmental sampling analysis, janitorial services, landscaping services, building maintenance services, portable toilet rental and maintenance, temporary lighting and trash and refuse collection. Also included are services for parking lot striping and maintenance, signage, furniture rental, employee travel for training, communications services, and Industrial Security services, as well as services provided by vendors with scopes of work and costs that fall outside of the major project scopes.

Specialty contracts include consultation services beyond regular staffing and will be required to manage the disparate activities and needs. Consultation services are expected to be proportional to the remaining site restoration scope. Examples of the services that will be needed include:

- Project oversight SME consultation services
- Onsite emergency medical care via remote physician

- Heating, ventilation and air conditioning maintenance and repair
- Legal representation in support of the NDCTP and CPUC proceedings
- Development and oversight of a decommissioning specific Storm Water Pollution Prevention Plan
- Implementation of site restoration plans, including permitting mitigation plan
- Site insurance and property taxes
- Other services to support emergent requirements and issues

Garbage

- Trash and recycling service will be provided to the site and will be similar to current services. Dumpsters will be provided for trash and recycling materials with pickups scheduled as needed. Containers also will be provided for battery and lightbulb disposal, with an appropriate pickup schedule. Costs for trash services are expected to be proportional to the site staffing levels.

Janitorial

- Janitorial services will be limited to the remaining PG&E facilities, which should be minimal or in the process of demobilization. This service also will empty trash and recycling containers and dispose of refuse in the dumpsters provided. The cost of these services is expected to be proportional to the site staffing levels.

4.1.3.5.15.2. Utilities

After the Part 50 licenses have been terminated, utilities will be provided through Cold and Dark to power the remaining site restoration activities and demobilize the DCPP Project Management field offices.

The electrical systems, both above-ground and below-ground, will be modified, re-routed, and maintained to provide essential services to the ISFSI and new security building.

Electricity

An electric meter will be installed to measure usage, then a new temporary system (see Section 4.1.1.2 on Cold and Dark power) will distribute power as required using new and existing electrical systems. After the Part 50 licenses have been terminated, the electrical requirement for completing the site restoration is minimal, related primarily to demobilization.

Compressed Gasses and Liquids

Compressed and liquid gasses will no longer be required in bulk at the site after the Part 50 licenses are terminated. Pick-up trucks and other site vehicles will be fueled off-site. Any other miscellaneous requirement that may arise will be addressed through a specialty contract.

Domestic and Service Water

Water, both domestic and service will be provided by trucking in tankers of treated water and filling tanks (see Section 4.1.1.2.2). This water will be distributed through existing, re-routed, or new piping systems as required. Drinking water will be provided by a bottled water service.

Sanitary System

The Sanitary system will be limited to holding tank and portable toilet facilities. These systems will be serviced as required.

Site Temporary Accommodations

See Section 4.1.1.9.14.2.

4.1.3.5.15.3. Licenses and Fees

DCPP is required to maintain its licenses, pay taxes, and provide insurance coverage until the Part 72 site-specific ISFSI license is terminated. Licensing fees, emergency planning fees, insurance and taxes are assessed to DCPP annually. Fees are assessed based on the current license condition or emergency planning participation required. Insurance coverage and rates are established by PG&E Corp., corporation and property tax is based on the depreciated value of the assets in service at the time.

Licensing Fee

The licensing fee is assessed by the NRC and the amount is established in regulatory guidance. The NRC also charges for labor and expenses related to its review of plan changes and other documents as well as its participation in public meetings, both in California and in Washington D.C., regarding DCPP. NRC review fees are expected to remain minimal after the Part 50 licenses are terminated.

Emergency Planning Fees

FEMA and the California Emergency Management Agency, along with other local and state agencies, all impose fees related to emergency planning and emergency response. Such fees and participation are expected to be minimal after the Part 50 licenses are terminated.

Permitting Fees

Most permits require fees to be submitted at the time of application to cover the cost of processing. Details of the permitting strategy as well as identified permits can be found in Section 3.1. The fee for each permit is a set, published amount by the governing agency and has been determined for each expected major discretionary and environmental permit. These application fees are different than the labor-based agency review fees that are covered in Section 4.1.3.5.13.

Permit fees have been evaluated for applicable work scope covered in license termination, spent fuel management, and site restoration. Based on the assessment, one-third of the permitting fees have been applied to site restoration.

Property Taxes

Property taxes are calculated based on the booked value of the DCPP assets in service. Current capital assets on PG&E's books and records will be fully depreciated to zero by 2026, therefore will not add value to the property tax base. Any spending on future tangible personal property used in the decommissioning process will be funded by the DTF. These dollars are generally expensed by the company and will not add value to the property tax base. Current facilities and new facilities related to the dry cask and spent fuel storage are funded by the DTF. These dollars are generally expensed by the company and will not add value to the property tax base. To the extent these dollars are capital dollars spent by the utility, spent fuel is generally viewed as contaminated property and will contribute little to no value to the property tax base. Land that PG&E owns and leases land from Eureka Energy will continue to be used in the same manner as it is today until decommissioning is completed. The estimated property taxes based on FY2018/2019 land values and FY2017/2018 tax rate are approximately $725,000 per fiscal year, July 1 through June 30.

Property and Liability Insurance

Property and Liability Insurance policies and coverage strategies are developed by PG&E Corporation. It has provided premium information based on the current Liability, Nuclear Liability Adjustments, Property, Nuclear Property Adjustments and Government Indemnity Insurance premiums as:

- $6 million per year while the reactor is shutdown, defueled; spent fuel may exceed 565°C and susceptible to cladding fire
- $350,000 per year once fuel can no longer exceed 565°C, fuel is no longer susceptible to cladding fire and significant inventory of mixed radioactive material remains on site
- $250,000 per year when all SNF is on the ISFSI pad or until all casks are transported off-site to an approved, off-site storage facility

5 - SCHEDULE

The DCPP Decommissioning Project schedule was developed to be consistent with the cost category sequencing set forth in Section 4.1. The schedule is based on implementation of a dual-unit decommissioning strategy (dismantling both DCPP units together) and is consistent with PG&E's milestone approach as shown in Table 6-1.

Section 5.1 provides a discussion of key (critical path) activities that drive the schedule, with summary schedules in Figure 5-1 and Figure 5-2. Section 5.2 provides schedule assumptions and ancillary schedule considerations. Section 5.3 provides the schedule summary supporting the cost breakdown structure, with a summary schedule provided in Figure 5-3.

5.1. CRITICAL PATH SCHEDULE SUMMARY

Schedule activity durations were established between milestones for each subproject; these durations were used to establish a critical path (minimum time needed) for the entire Decommissioning Project. Critical path activities and bottlenecks/constraints were determined for those items that highly influence the schedule. These activities include:

- **Units 1 and 2 spent fuel cooling window**: Cooling time reduces the heat load of spent fuel assemblies. The initial critical path cooling window activity duration extends approximately 7 years after Unit 2 shut down (see Section 3.5 for further discussion). The spent fuel is cooled in the SFPs until heat loads are low enough to transfer to dry cask storage in accordance with the DC ISFSI license from the NRC.
- **Units 1 and 2 spent fuel and GTCC waste transfer to the DC ISFSI:** While the SFPs are being used to store spent fuel or GTCC waste, systems and structures that support the SFPs' operation cannot be demolished. Once transfer to the DC ISFSI is complete, several work activities may begin.
- **Units 1 and 2 RPV and Internals segmentation, packaging, and disposal:** Removal and disposal of the RPV and internals has typically been performed long after final reactor shutdown which allows for substantial radioactive decay of the irradiated materials. In addition, many of the previously segmented reactors had poor operational performance or unexpectedly ceased operation early in life, resulting in considerably lower levels of radiation as compared to that which will be present in the DCPP RPVs and internals when Units 1 and 2 permanently shut down in 2024 and 2025, respectively. Put another way, total radionuclide concentrations in the DCPP RPVs and internals will be significantly higher than any that have been encountered during previous segmentation activities at other plants. To address this unique challenge, a team of subject matter experts with vast decommissioning experience developed a comprehensive segmentation plan and schedule drawing from actual experience obtained from previously

executed RPV and internals segmentation projects. The plan addresses the health and safety risks posed by the inherent danger and complexity of this work, and is based on site specific design characteristics, operating parameters, and materials of construction for the DCPP Units 1 and 2 RPVs and internals.

Due to close proximity to the nuclear fuel, the RPV and internals become highly radioactive, and the radionuclide concentrations estimated to be present at end of operation result in extremely high levels of radiation emanating from the materials. To develop a basis for the radionuclide isotopes and concentrations that will be present within the RPVs and internals at the time of final shutdown for Units 1 and 2, a unit specific waste characterization analysis was performed by consultants with experience and expertise in the area of RPV and internals segmentation and disposal. Based on results of the waste characterization analysis, segmentation and packaging plans that meet NRC and DOT regulation limits for transporting and disposing of radioactive waste were developed for both Units 1 and 2. Since the cost to dispose of Class A waste is significantly less than Class B or Class C waste, the plans ensure the quantity of waste that will be disposed of as Class A is maximized.

Results of the waste characterization analysis support the determination that the optimal time to begin RPV and internals segmentation and packaging is approximately 5 years after shutdown. This allows time for adequate radioactive decay of short-lived gamma-emitting radionuclides, which will reduce accumulation of worker dose; allow for immediate transportation of waste to licensed off-site waste disposal facilities; optimize RPV and internals segmentation duration by allowing for larger individual pieces; and support timely reduction in security staffing requirements for areas beyond the ISFSI pad, by ensuring the reactor internals waste classified as GTCC is removed from the Containment Buildings and placed for storage on the ISFSI pad no later than seven years after Unit 2 is shut down.

To minimize the total schedule duration for Units 1 and 2 RPV and internals segmentation activities, segmentation of the Unit 2 RPV and internals will be performed concurrent with completion of the Unit 1 RPV and internals segmentation activities. The start of activities associated with Unit 2 are labor resource dependent following a period of operating experience obtained from operations within Unit 1. This results in an offset of approximately seven months between the start of segmentation operations between Units 1 and 2. To support parallel segmentation activities for both Units 1 and 2, two complete sets of RPV and internals segmentation equipment will be provided. The total duration for both units, with Unit 2 work in parallel commencing seven months after Unit 1 start is approximately 56 months.

- **Unit 2 Containment Building interior demolition[12]:** Due to ALARA and safety concerns, the containment building interior demolition work cannot take place until (1) the spent fuel and GTCC waste are removed from the SFP, and (2) the last of the major components (i.e., RPV and internals as described above) are removed.
- **Unit 2 Auxiliary Building and FHB demolitions:** The Auxiliary Building and FHB demolitions cannot take place until the spent fuel and GTCC waste are removed from the SFP.
- **Unit 2 Containment Building demolition:** Due to ALARA and safety concerns, this containment building exterior demolition work cannot take place until (1) the spent fuel and GTCC waste are removed from the SFP, and (2) the interior has been demolished.
- **Radioactive Waste Processing Facility:** The formerly titled Warehouse Building, Building 115, is being repurposed as the Radioactive Waste Processing Facility. It cannot be demolished until all other buildings and structures with radioactive waste have been demolished.
- **Breakwaters demolition:** Breakwater removal is scheduled late in the project to allow the breakwater structure to maintain a calm water supply suction location for plant demolition needs and to distribute waste stream volumes across the project so as to not overcome the capability of transferring waste offsite. This also allows for Final Status Surveys to be completed while the Breakwaters are being removed. Earlier removal of the breakwater will require identification of an alternate water supply path and will challenge offsite waste transportation activities.
- **Final landscaping, re-vegetation, and demobilization:** This is the last activity to be completed for non-ISFSI decommissioning. Because overhead costs can be reduced or eliminated once this activity is completed, it is imperative to the budget that it be finished as soon as possible.
- **Spent fuel and GTCC waste transfer from the ISFSI to a Permanent Offsite Facility:** Transfer to a permanent offsite facility cannot begin until all spent fuel and GTCC waste has been moved from the SFPs to the ISFSI and the offsite facility is ready to accept the spent fuel and GTCC waste (see Section 3.5.8).
- **ISFSI demolition activities:** The ISFSI demolition cannot begin until all spent fuel and GTCC waste have been transferred to the DOE. The critical path activities related to ISFSI demolition include mobilizing/demobilizing contractors; removing utilities, ancillary roads, fences, barriers, and the ISFSI pad; performing soil remediation; backfilling, grading, and landscaping; establishing erosion control; and revegetation.

It is important to track critical path activities as they can put the remainder of the schedule at-risk. For example, if the spent fuel and GTCC waste are not transferred to the DC ISFSI as-scheduled, then building demolition cannot be completed, and the licenses cannot be terminated. In addition, although not initially determined to be a critical path activity, an activity may become critical path as new

[12] It should be noted that demolitions of the Unit 1 Containment Building, Auxiliary Building, and FHB are not considered critical path because the Unit 1 RPV and internals segmentation and removal complete five months before Unit 2 RPV and internals segmentation and removal complete. This five-month lead allows the Unit 1 demolitions to start sooner than Unit 2; thus, making it non-critical path.

information is identified during the detailed planning efforts or project execution. For instance, new critical path activities may be identified if existing critical path activities are completed significantly earlier, significantly delayed, or if there is a change to the order of work activities.

In developing the schedule, several options were considered to minimize the critical path activities such as conducting work in parallel and completing planning work before physical work begins. Facets of these options were incorporated into the schedule as follows:

- RPV and internals segmentation were originally scheduled to occur in a series (segmentation starts at the second unit after it's completed at the first unit). Adding additional equipment and personnel so that segmentation could be completed in parallel for both units as much as possible reduced the time to do this by 13 months. That savings in overhead costs more than offsets the added cost for additional equipment and personnel.
- The feasibility of commencing segmentation and disposal of the RPV and internals at approximately two years following final reactor shutdown was evaluated by decay correcting the results of the waste characterization analysis and drafting representative segmentation and packaging plans. To ensure the ability to transport the loaded waste containers beginning approximately two years following shutdown of the units, the segmentation and packaging plans were developed based on the capacity and radioactivity limitations of the NRC licensed TN-RAM Type B transportation cask. The capacity and radioactivity limitations of the cask necessitate exorbitant time and effort to segment the RPV and internals into sizes sufficiently small to fit within the cask, ultimately requiring the use of greater than 100 waste containers and Type B waste shipments per unit. This was contrary to goal of minimizing the amount of time required to segment the RPV and internals and minimizing the number of waste shipments requiring the use of a NRC licensed Type B transportation cask. Therefore, commencing segmentation and disposal of the RPV and internals at approximately two years following final reactor shutdown was deemed unreasonable.
- The time spent for (1) spent fuel and GTCC waste transfer to the ISFSI and (2) RPV and internals segmentation and disposal were optimized to allow for as many parallel activities as possible. By incorporating parallel work, critical path building demolition (i.e., Containment Buildings, Auxiliary Building, and FHBs) can begin as soon as possible.
- Planning, licensing, and permitting efforts were originally scheduled to occur after both units are permanently shut down. However, to save time and money, they are scheduled to be completed prior to permanent shutdown.

5.2. SCHEDULE ASSUMPTIONS AND ADDITIONAL CONSIDERATIONS

This section outlines key factors, other than critical path activities, considered during the development of the (1) DCPP Demolition and Site Restoration schedule and (2) ISFSI Demolition and ISFSI Site Restoration schedule. Assumptions used in the schedule are also provided.

5.2.1. Schedule Considerations

DCPP Demolition and Site Restoration

Figure 5-1 provides the level 3 schedule for non-ISFSI decommissioning. As shown in Figure 5-1, the total decommissioning time for each unit is minimized by parallel work activities. For example, because each unit has a specific shutdown date (November 2024 for Unit 1 and August 2025 for Unit 2), the Unit 1 activities will begin while Unit 2 is still operating, including transferring the Unit 1 spent fuel from the reactor to the Unit 1 SFP to begin cooling.

The DCPP Demolition and Site Restoration schedule depends heavily on the availability of buildings for demolition and then site restoration. For example, systems are needed to support SFP cooling until the spent fuel and GTCC waste are transferred to the DC ISFSI.

The DCPP Demolition and Site Restoration schedule is also based on key considerations such as ensuring safe working conditions and minimizing environmental impacts. For instance, although the DCPP units will be shut down in 2024 and 2025, physical dismantlement of radioactive equipment and buildings will not begin until 2029. This allows time for radioactivity to decay (i.e., for doses to decrease) and decontamination, which in turn will reduce overall worker dose exposure during dismantlement. Similarly, as discussed in detail in Section 4.1.1.2.1, one of the most significant safety hazards associated with decommissioning power plants is the risk posed by workers and equipment coming in direct contact with exposed and energized electrical circuits. To minimize the potential for this, an alternate external power supply (Cold and Dark Power) will be installed to support decommissioning work and for selected power plant loads and lighting.

ISFSI Demolition and ISFSI Site Restoration

Figure 5-2 provides the level 3 schedule for ISFSI Demolition and ISFSI Site Restoration. It includes the time that the spent fuel and GTCC waste will be stored at the DC ISFSI (termed ISFSI operations), as well as the period of time that the ISFSI will be demolished (after the DOE has taken possession of all materials stored at the DC ISFSI), and that time for the ISFSI site to be restored. The total duration of this phase is minimized by parallel work activities. This schedule depends heavily on the DOE schedule for taking possession of the DCPP spent fuel and GTCC waste, which is based on information in Section 3.5.8.

5.2.2. Schedule Assumptions

The schedule reflects the results of a logic-driven activity-based schedule for the DCPP Decommissioning Project. The following assumptions were made in developing the schedule:

- Detailed decommissioning planning will begin in 2019 (see Section 4.1.1.1.1)
- Permanent shutdown for Units 1 and 2 is November 2024 and August 2025, respectively
- SNF and GTCC waste will be moved to ISFSI within seven years after Unit 2 shutdown
- The SFP zirconium fire period will end 18 months after each unit shutdown

- Major building demolition will not occur until after the main power block PA is devitalized and security requirements are relaxed
- The Part 50 licenses will be terminated in May 2038
- All SNF and GTCC waste will be removed from DC ISFSI by August 2067
- The Part 72 site-specific license will be terminated in May 2072
- All work (except cask transfer activities) will be performed during a 10-hour workday, four days per week (termed a 4x10 work schedule), with no overtime
- Activities that do not follow a 4x10 work schedule will be performed with separate crews working on different shifts with a corresponding charge for the second shift
- The schedule is optimized to allow multiple crews to work parallel activities to the maximum extent possible allowing for (1) access to various site facilities to execute work; (2) removal and/or staging areas; and (3) safety measures required to ensure safe efficient decommissioning of the site's equipment, components, and structures
- Critical path is determined based on the systems and scopes of work in the Decommissioning Project. Delay of any part of the critical path will delay the overall project completion date

The DCPP decommissioning schedule was developed by vendors with industry expertise in nuclear decommissioning and by personnel with direct experience with HBPP decommissioning. As a result, the schedule incorporates best practices and lessons learned from several sites that have undergone or are undergoing decommissioning.

5.3. SCHEDULE SUMMARY SUPPORTING COST BREAKDOWN STRUCTURE

The Milestone Schedule contained in Figure 5-3 reflects the Milestone Framework described in Section 6.1. Figure 5-3 identifies each Milestone, and the summary bars display the time required for executing each scope of work identified.

Figure 5-1: DCPP Demolition and Site Restoration Schedule

DCPP Decommissioning Summary Schedule

Unit 2 Shutdown to License Termination = 12 years, 9 months (approx)
Based on Field Work Only and Excludes ISFSI Restoration

#	Activity Name	Dur in Months	Start	Finish
1	***1) Milestones***			
2	Unit 1 Shutdown	0		02-Nov-24*
3	Unit 2 Shutdown	0		26-Aug-25*
4	Zirc Fire Risk Ends / Power Block Mods Complete	0		26-Feb-27*
5	Spent Fuel at ISFSI - Adjust PA Boundary	0		24-Jun-32*
6	RVI / RPV Removals Complete	0		17-Mar-33*
7	Building Demolitions Complete - minus Breakwaters	0		07-Jun-35*
8	Part 50 LAR Approved	0		27-May-38*
9	DOE Ready for DCPP SNF & GTCC Waste Transfer	0		01-Jun-38*
10	Site Restoration Complete / Commence Monitoring	0		07-Dec-38*
11	***2) Decontamination & System/Area Closures***			
12	Chemical Decontaminations	7	08-Jan-26	19-Aug-26
13	Field Characterizations - Non Rad	6	09-Mar-26	31-Aug-26
14	Field Characterizations - Rad	7	31-Mar-26	26-Oct-26
15	Containment System & Area Closure - Interior Unit 1	12	02-Jul-26	21-Jun-27
16	Auxiliary Bldg Abatement & Removals	8	20-Aug-26	15-Apr-27
17	Containment System & Area Closure - Interior Unit 2	13	25-Nov-26	05-Jan-28
18	Intake Structure System & Area Closure	6	23-Dec-26	22-Jun-27
19	Balance of Site System & Area Closure	6	17-Jun-27	22-Dec-27
20	Turbine Bldg Abatement & Removals	22	01-Dec-27	11-Oct-29
21	Containment System & Area Closure - Exterior Unit 1	10	20-Dec-27	01-Nov-28
22	Containment System & Area Closure - Exterior Unit 2	10	30-Dec-27	16-Oct-28
23	Auxiliary Bldg System & Area Closure	29	06-Jan-28	18-Jun-30
24	Turbine Bldg System & Area Closure - Unit 2	12	11-Oct-28	11-Oct-29
25	Remediate Alpha Contaminations	16	31-May-29	09-Oct-30
26	Turbine Bldg System & Area Closure - Unit 1	20	15-Oct-29	30-Jun-31
27	Turbine Bldg ACM Siding Removals	15	17-Jun-31	30-Sep-32
28	Fuel Handling Bldg System & Area Closure - Unit 1	13	10-Sep-31	21-Oct-32
29	Fuel Handling Bldg System & Area Closure - Unit 2	15	20-Apr-32	07-Jul-33
30	Fuel Handling Bldg ACM Siding Removals	16	24-Aug-32	27-Dec-33
31	Discharge Structure System & Area Closure	5	20-Dec-32	24-May-33
32	Rad Waste / Laundry Bldg System & Area Closure	10	21-Mar-33	25-Jan-34
33	General Surveys & Final Decontaminations	23	28-Apr-33	21-Mar-35
34	Final Aux Bldg Assessment & Lead Abatement	1	14-Jun-34	26-Jul-34
35	***3) Large Component Removals***			
36	Legacy Large Component Segmentation & Disposal	13	20-Aug-26	15-Sep-27
37	LCR Containment Openings & Lift Systems	6	26-Oct-26	13-Apr-27
38	Main Exciter, Generator & Turbine Removals - Unit 1	9	16-Aug-27	11-May-28
39	Steam Generator & Pressurizer Removals - Unit 1	11	20-Sep-27	17-Aug-28
40	MSR, FW Heater, Main Condenser & DG Removals - Unit 1	13	16-May-28	12-Jun-29
41	Steam Generator & Pressurizer Removals - Unit 2	12	13-Jul-28	28-Jun-29
42	RCS Pump Removals - Unit 1	7	21-Aug-28	04-Apr-29
43	Clear RPV Head & Manipulator Crane Removal - Unit 1	2	05-Apr-29	30-May-29
44	Main Exciter, Generator & Turbine Removals - Unit 2	9	14-Jun-29	19-Mar-30
45	RCS Pump Removals - Unit 2	7	02-Jul-29	14-Feb-30
46	Clear RPV Head & Manipulator Crane Removal - Unit 2	2	19-Feb-30	11-Apr-30
47	MSR, FW Heater, Main Condenser & DG Removals - Unit 2	13	21-Mar-30	24-Apr-31
48	RPV Head Removal & Staging for Disposal - Unit 1	3	29-Jan-31	17-Apr-31
49	RPV Head Removal & Staging for Disposal - Unit 2	4	19-Aug-31	23-Dec-31
50	***4) Spent Fuel Transfers & Reactor Segmentations***			
51	Spent Fuel Pool Cooling Window	92	02-Nov-24*	24-Jun-32
52	Spent Fuel Pool Island Installation - Unit 1	10	03-Mar-25	31-Dec-25
53	Spent Fuel Pool Island Installation - Unit 2	10	02-Feb-26	25-Nov-26
54	RVI / RPV Demo Contractor Mobilization & Unit 1 Prep	2	13-May-30	07-Jul-30
55	RVI Segmentation & Removal - Unit 1	20	08-Jul-30	04-Mar-32
56	Spent Fuel/GTCC Transfers to ISFSI - Unit 1	11	19-Aug-30	11-Jul-31
57	RVI/RPV Transportation & Disposal - Unit 1	31	24-Sep-30	05-May-33
58	RVI Segmentation & Removal - Unit 2	18	27-Jan-31	15-Jul-32
59	RVI/RPV Transportation & Disposal - Unit 2	29	09-Apr-31	29-Aug-33
60	Spent Fuel/GTCC Transfers to ISFSI - Unit 2	11	14-Jul-31	24-Jun-32
61	Class A/B/C Waste Storage in Unit 1 SFP	13	04-Nov-31	23-Nov-32
62	RPV Segmentation & Removal - Unit 1	9	08-Mar-32	30-Nov-32
63	RPV Segmentation & Removal - Unit 2	8	19-Jul-32	17-Mar-33

Legend Unit 1 | Unit 2 | Common | Critical | ◆ Milestone

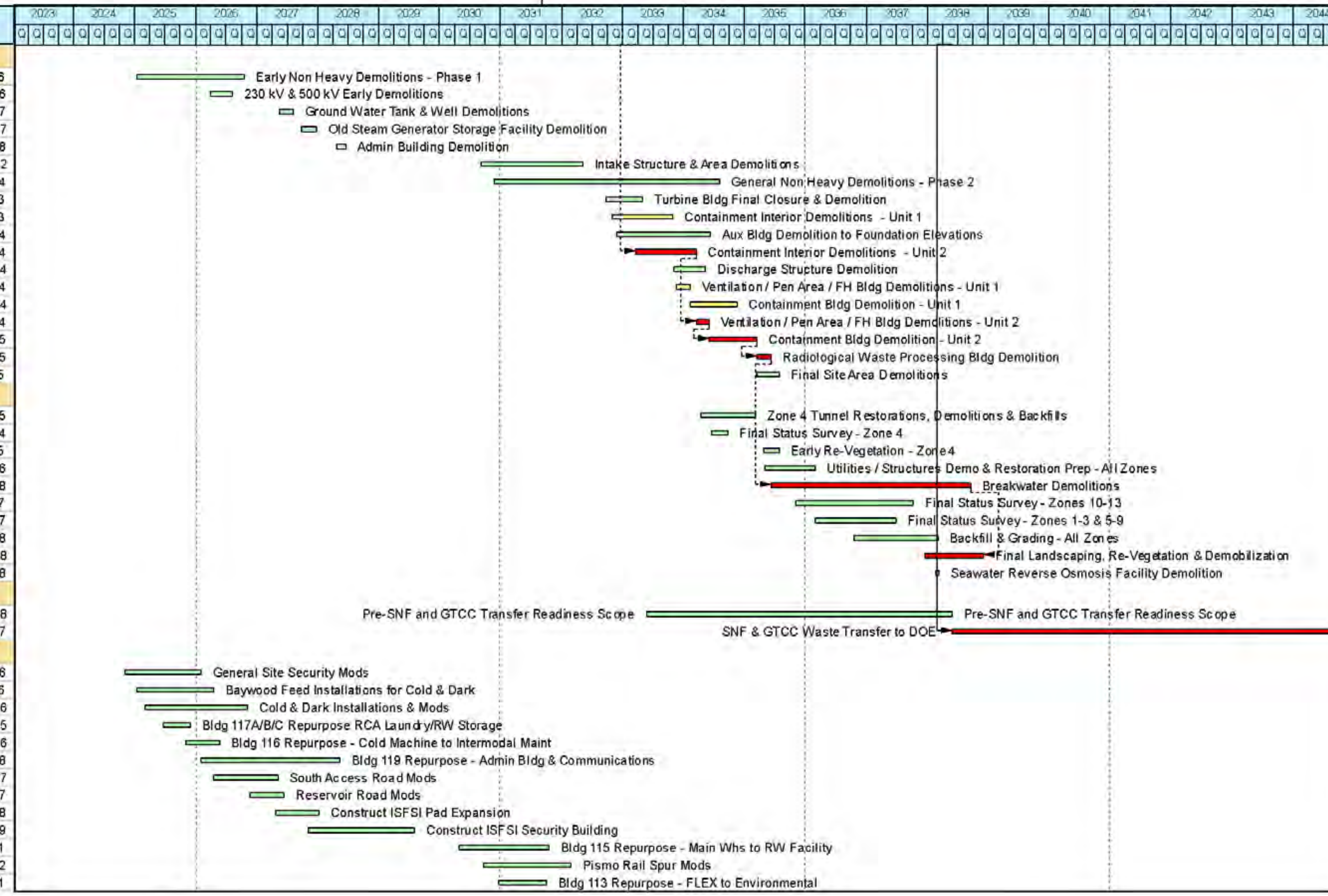
1 of 2

Pacific Gas and Electric Company
Diablo Canyon Decommissioning

DCPP Decommissioning Summary Schedule

Unit 2 Shutdown to License Termination = 12 years, 9 months (approx)
Based on Field Work Only and Excludes ISFSI Restoration

#	Activity Name	Dur in Months	Start	Finish
64	***5) Building & Structural Demolitions***			
65	Early Non Heavy Demolitions - Phase 1	21	13-Jan-25	14-Oct-26
66	230 kV & 500 kV Early Demolitions	4	26-Mar-26	05-Aug-26
67	Ground Water Tank & Well Demolitions	3	17-May-27	10-Aug-27
68	Old Steam Generator Storage Facility Demolition	3	23-Sep-27	22-Dec-27
69	Admin Building Demolition	2	24-Apr-28	19-Jun-28
70	Intake Structure & Area Demolitions	20	10-Sep-30	06-May-32
71	General Non Heavy Demolitions - Phase 2	45	21-Nov-30	07-Aug-34
72	Turbine Bldg Final Closure & Demolition	7	27-Sep-32	27-Apr-33
73	Containment Interior Demolitions - Unit 1	12	01-Nov-32	26-Oct-33
74	Aux Bldg Demolition to Foundation Elevations	18	29-Nov-32	13-Jun-34
75	Containment Interior Demolitions - Unit 2	12	21-Mar-33	15-Mar-34
76	Discharge Structure Demolition	6	09-Nov-33	16-May-34
77	Ventilation / Pen Area / FH Bldg Demolitions - Unit 1	3	17-Nov-33	13-Feb-34
78	Containment Bldg Demolition - Unit 1	9	14-Feb-34	15-Nov-34
79	Ventilation / Pen Area / FH Bldg Demolitions - Unit 2	3	16-Mar-34	06-Jun-34
80	Containment Bldg Demolition - Unit 2	9	07-Jun-34	14-Mar-35
81	Radiological Waste Processing Bldg Demolition	3	15-Mar-35	07-Jun-35
82	Final Site Area Demolitions	5	15-Mar-35	31-Jul-35
83	***6) Site Surveys & Restorations***			
84	Zone 4 Tunnel Restorations, Demolitions & Backfills	11	19-Apr-34	07-Mar-35
85	Final Status Survey - Zone 4	3	21-Jun-34	25-Sep-34
86	Early Re-Vegetation - Zone 4	3	01-May-35	30-Jul-35
87	Utilities / Structures Demo & Restoration Prep - All Zones	10	09-May-35	28-Feb-36
88	Breakwater Demolitions	39	11-Jun-35	21-Sep-38
89	Final Status Survey - Zones 10-13	23	07-Nov-35	13-Oct-37
90	Final Status Survey - Zones 1-3 & 5-9	16	03-Mar-36	25-Jun-37
91	Backfill & Grading - All Zones	16	20-Oct-36	03-Mar-38
92	Final Landscaping, Re-Vegetation & Demobilization	12	22-Dec-37	07-Dec-38
93	Seawater Reverse Osmosis Facility Demolition	1	22-Feb-38	11-Mar-38
94	***7) SNF and GTCC Waste Transfer to Off-Site Facility***			
95	Pre-SNF and GTCC Transfer Readiness Scope	58	01-Jun-33	27-May-38
96	SNF & GTCC Waste Transfer to DOE	338	01-Jun-38	01-Aug-67
97	***8) Infrastructure & Support Projects***			
98	General Site Security Mods	15	04-Nov-24	02-Feb-26
99	Baywood Feed Installations for Cold & Dark	15	15-Jan-25	16-Apr-26
100	Cold & Dark Installations & Mods	20	27-Feb-25	05-Nov-26
101	Bldg 117A/B/C Repurpose RCA Laundry/RW Storage	5	23-Jun-25	26-Nov-25
102	Bldg 116 Repurpose - Cold Machine to Intermodal Maint	7	03-Nov-25	20-May-26
103	Bldg 119 Repurpose - Admin Bldg & Communications	27	02-Feb-26	11-May-28
104	South Access Road Mods	12	22-Apr-26	06-May-27
105	Reservoir Road Mods	7	24-Nov-26	10-Jun-27
106	Construct ISFSI Pad Expansion	9	22-Apr-27	06-Jan-28
107	Construct ISFSI Security Building	21	04-Nov-27	07-Aug-29
108	Bldg 115 Repurpose - Main Whs to RW Facility	18	01-May-30	15-Oct-31
109	Pismo Rail Spur Mods	17	25-Sep-30	02-Mar-32
110	Bldg 113 Repurpose - FLEX to Environmental	9	23-Dec-30	01-Oct-31



Legend Unit 1 | Unit 2 | Common | Critical | ◆ Milestone

Figure 5-2: ISFSI Demolition and ISFSI Site Restoration Schedule

ISFSI Restoration Schedule

ISFSI Site Restoration Duration = 3 years, 6 months
Excludes Follow-on Monitoring

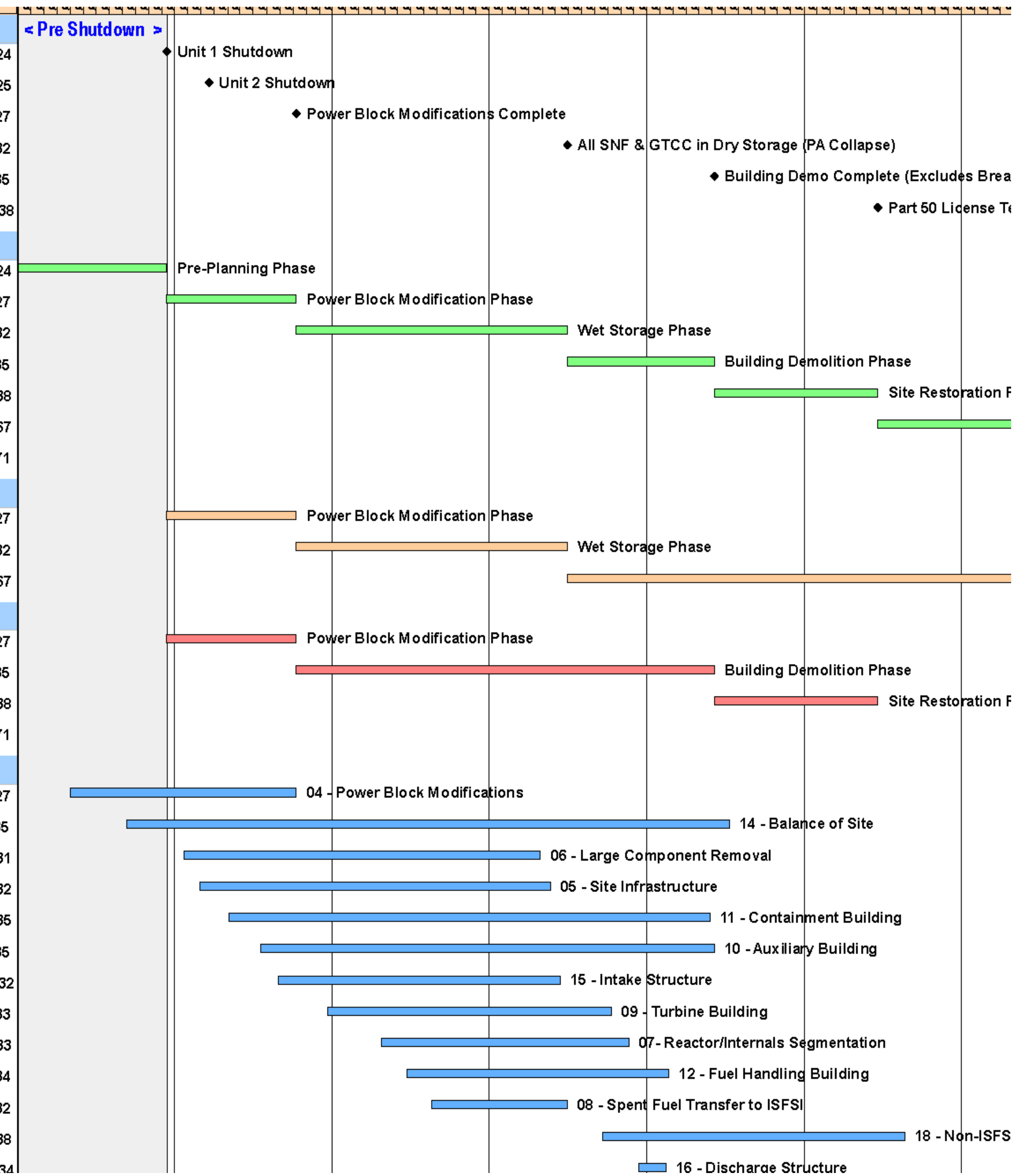
#	Activity Name	Dur in Months	Start	Finish
1	***1) GTCC and Spent Nuclear Fuel Waste Transfer to DOE***			
2	SNF & GTCC Waste Transfer to DOE	338	01-Jun-38	01-Aug-67
3	***2) ISFSI Site Restoration***			
4	Mobilize Contractor - Tower and Line Removals for Utils & Struc Demo - Balance of Site Restoration	1	27-Jun-67	01-Aug-67
5	Mobilize Demolition Contractor for ISFSI Demolition - ISFSI Decommissioning	1	02-Aug-67	06-Sep-67
6	Prepare T Lines for Utils & Struc Demo - Balance of Site Restoration	1	02-Aug-67	14-Sep-67
7	Operate Laydown Yard - T Line and Tower Removals for Utils & Struc Demo - Balance of Site Restoration	5	02-Aug-67	29-Dec-67
8	Demolish ISFSI Pads- ISFSI Decommissioning	13	07-Sep-67	29-Oct-68
9	Demolish Utilities and General Demolition for ISFSI Demolition - ISFSI Decommissioning	13	07-Sep-67	29-Oct-68
10	Remove T Lines for Utils & Struc Demo - Balance of Site Restoration	2	15-Sep-67	30-Nov-67
11	Remove Towers for Utils & Struc Demo - Balance of Site Restoration	0	01-Dec-67	13-Dec-67
12	Remove Tower Foundations for Utils & Struc Demo - Balance of Site Restoration	1	14-Dec-67	29-Dec-67
13	Demobilize T&L Contractor for Utils & Struc Demo - Balance of Site Restoration	1	03-Jan-68	07-Feb-68
14	Demolish Fences and Barriers for ISFSI Demolition - ISFSI Decommissioning	9	02-Feb-68	29-Oct-68
15	Demolish ISFSI Ancillary Roads - ISFSI Demolition - ISFSI Decommissioning	0	22-Oct-68	29-Oct-68
16	Demobilize Demolition Contractor - ISFSI Demolition - ISFSI Decommissioning	1	30-Oct-68	05-Dec-68
17	Perform a Radiological Soil Remediation for ISFSI Site Restoration	0	13-Dec-68	20-Dec-68
18	Perform Radiological Soil Remediation Analytical for ISFSI Site Restoration	1	26-Dec-68	14-Jan-69
19	Perform Chemical Soil Remediation for ISFSI Site Restoration	1	15-Jan-69	20-Feb-69
20	Demobilize Soil Remediation Contractor for ISFSI Site Restoration	0	21-Feb-69	21-Feb-69
21	Mobilization for Grading & Landscaping - ISFSI Site Restoration	0	25-Feb-69	04-Mar-69
22	Site Preparation for Grading & Landscaping - ISFSI Site Restoration	1	05-Mar-69	20-Mar-69
23	Backfill and grading at Shooting Range for Grading & Landscaping - ISFSI Site Restoration	4	21-Mar-69	01-Aug-69
24	Mass Excavation of North slope of ISFSI for Grading & Landscaping - ISFSI Site Restoration	10	21-Mar-69	04-Feb-70
25	Backfilling and grading ISFSI for Grading & Landscaping - ISFSI Site Restoration	7	05-Aug-69	11-Mar-70
26	Restoration of Dirt roads for Grading & Landscaping - ISFSI Site Restoration	4	12-Mar-70	14-Jul-70
27	Work Implementation Final Site Survey - ISFSI Site Restoration	2	18-Jun-70	05-Aug-70
28	Erosion Control Stabilization ISFSI area for Grading & Landscaping - ISFSI Site Restoration	1	15-Jul-70	31-Jul-70
29	Revegetation Construction for Grading & Landscaping - ISFSI Site Restoration	6	04-Aug-70	28-Jan-71
30	Demobilization contractor for Final Site Survey - ISFIS Site Restoration	0	06-Aug-70	06-Aug-70
31	Revegetation Demobilization for Grading & Landscaping - ISFSI Site Restoration	0	29-Jan-71	29-Jan-71
32	ISFSI Site Restoration Complete	0		02-Feb-71*

Legend: Common — Critical — ◆ Milestone

1 of 1

Figure 5-3: DCPP Decommissioning Milestone Schedule

Milestones		
Unit 1 Shutdown		02-Nov-24
Unit 2 Shutdown		26-Aug-25
Power Block Modifications Complete		27-Apr-27
All SNF & GTCC in Dry Storage (PA Collapse)		24-Jun-32
Building Demo Complete (Excludes Breakwater)		11-Apr-35
Part 50 License Term Complete		27-May-38
Staffing & Administrative		
Pre-Planning Phase	01-Jan-22	02-Nov-24
Power Block Modification Phase	04-Nov-24	27-Apr-27
Wet Storage Phase	28-Apr-27	24-Jun-32
Building Demolition Phase	25-Jun-32	11-Apr-35
Site Restoration Phase	12-Apr-35	07-Dec-38
ISFSI Operations Phase	28-May-38	01-Aug-67
ISFSI Restoration Phase	02-Aug-67	02-Feb-71
Security & Operations		
Power Block Modification Phase	04-Nov-24	27-Apr-27
Wet Storage Phase	28-Apr-27	24-Jun-32
ISFSI Operations	25-Jun-32	01-Aug-67
Waste / Transportation		
Power Block Modification Phase	04-Nov-24	27-Apr-27
Building Demolition Phase	28-Apr-27	11-Apr-35
Site Restoration Phase	12-Apr-35	07-Dec-38
ISFSI Restoration Phase	02-Aug-67	02-Feb-71
Discrete Scope		
04 - Power Block Modifications	03-Jan-23	27-Apr-27
14 - Balance of Site	25-Jan-24	31-Jul-35
06 - Large Component Removal	04-Mar-25	23-Dec-31
05 - Site Infrastructure	23-Jun-25	02-Mar-32
11 - Containment Building	08-Jan-26	14-Mar-35
10 - Auxiliary Building	20-Aug-26	11-Apr-35
15 - Intake Structure	23-Dec-26	06-May-32
09 - Turbine Building	01-Dec-27	27-Apr-33
07- Reactor/Internals Segmentation	18-Dec-28	29-Aug-33
12 - Fuel Handling Building	31-May-29	06-Jun-34
08 - Spent Fuel Transfer to ISFSI	28-Nov-29	24-Jun-32
18 - Non-ISFSI Site Restoration	02-Mar-33	07-Dec-38
16 - Discharge Structure	09-Nov-33	16-May-34



6 - REVIEW OF COMPLETED PROJECTS

The purpose of this Chapter is to describe how PG&E will track actual DCPP decommissioning expenses in order to present completed projects for reasonableness review. PG&E proposes to use a milestone framework which breaks down decommissioning work into specific milestones with specified scopes of work, cost estimates, and schedules. PG&E also will maintain a Decision Log with a written record of key decisions impacting the cost, scope, or timing of a Milestone.

The DCE provides PG&E's forecast of decommissioning costs and schedule, which are reviewed for reasonableness upon completion of scopes of work in subsequent NDCTPs. Since this DCE is a new and site-specific estimate, the Commission has directed PG&E to develop a cost accounting system for DCPP that will facilitate tracking decommissioning expenses by major subprojects; allow for comparison to previously approved estimates of activities, costs, and schedules; and require written record of key decisions about cost, scope, or timing of a major project or activity (i.e., varies by plus or minus 10 percent) (See Reference 6.1).

PG&E proposes to adopt a milestone framework similar to the approach proposed for SONGS. The DCPP milestone framework allocates decommissioning work into 19 milestones. PG&E will track decommissioning expenses by milestone, which will readily enable a comparison to actual costs and schedule to previously approved estimates.[13]

6.1. MILESTONE FRAMEWORK

The DCE (See Chapter 4) is organized into three major cost categories (License Termination, Spent Fuel Management, and Site Restoration). This organization follows the approach used by PG&E for developing its estimate of the total costs of decommissioning. While PG&E developed the milestones using the DCE as input, the actual milestones PG&E has identified group logical scopes of work somewhat differently.

Table 6-1 identifies the 19 Milestones, each with identified subprojects. Subject to Commission review in subsequent NDCTPs, PG&E proposes that milestones may be modified to allow for (1) moving activities from one major subproject to another, (2) adding new activities, and (3) adjusting the proposed decommissioning schedule.

[13] PG&E has based this DCE on a physical decommissioning plan. However, while the cost estimate and schedule will remain relevant for comparison purposes, it can be expected that as decommissioning approaches, PG&E will make changes and improvements, and this DCE does not represent a commitment to perform decommissioning work exactly as presented in the DCE.

Table 6-1: DCPP Decommissioning Milestones

ID	Scope Description	Labor	Material	Equipment	Disposal	Other	Contingency	Grand Total
		(in thousands)						
Unassigned Cost Milestones								
1	**Program Management, Oversight, and Fees**	**$895,127**	**$21,837**	**$10,047**		**$358,212**	**$176,823**	**$1,462,045**
1.01	Staffing	629,462				8,135	85,960	723,557
1.02	Severance	135,155					20,273	155,429
1.03	Energy					59,601	8,940	68,541
1.04	Insurance					25,393	2,539	27,932
1.05	Property Tax					36,556	3,656	40,211
1.06	NRC Fees / Reviews	28,474				34,666	4,956	68,096
1.07	Association/Industry Fees					7,323	732	8,055
1.08	Facility Maintenance	13,579				5,251	2,824	21,654
1.09	Water Management	9,647	3,055	8,569		41,976	9,487	72,734
1.10	Permits	21,395				31,467	5,011	57,872
1.11	Future Land Use	11,654	37				669	12,361
1.12	Spent Fuel Management Plan	25,890				26,345	7,827	60,062
1.13	License Termination Plan	10,760	456			150	2,841	14,207
1.14	Site Characterization	6,058	6	1,373		4,111	3,464	15,013
1.15	Emergency Planning - Senate Bill 1090					38,668	5,800	44,468
1.16	Emergency Planning	2,621				21,303	3,589	27,513

ID	Scope Description	Labor	Material	Equipment	Disposal	Other	Contingency	Grand Total
		(in thousands)						
1.17	Consumables	431	18,283	105		11,748	7,642	38,209
1.18	Public Outreach & Stakeholder Engagement					5,520	611	6,131
2	**Security Operations**	**$476,576**	**$9,358**			**$1,620**	**$73,133**	**$560,686**
2.01	Security Staffing	471,360					70,704	542,064
2.02	Other Security Related Costs	5,216	9,358			1,620	2,429	18,622
3	**Waste/Transportation/Material Management (Excluding: Breakwater, RPV/RVI Segmentation, & Large Component Removal)**	**$115,347**	**$10,166**	**$19,103**	[redacted]	[redacted]	[redacted]	**$855,211**
3.01	Waste & Transportation Management	87,325	7,774	11,374	[redacted]	[redacted]	[redacted]	[redacted]
3.02	Transportation		155	3,444	[redacted]	[redacted]	[redacted]	[redacted]
3.03	Disposal				[redacted]	[redacted]	[redacted]	[redacted]
3.04	Material Management	28,022	2,238	4,285	[redacted]	[redacted]	[redacted]	[redacted]
3.05	Asset Recovery				[redacted]	[redacted]	[redacted]	[redacted]
3.06	GTCC Disposal				30,000		7,500	37,500
Discrete Cost Milestones								
4	**Power Block Modifications**	**$47,104**	**$14,749**	**$3,972**		**$4,355**	**$10,527**	**$80,707**
4.01	U1 Spent Fuel Pool Island	4,270	817	94		627	871	6,680
4.02	U2 Spent Fuel Pool Island	3,569	1,019	101		606	794	6,090
4.03	Install 230kV Baywood Feed	10,830	2,329	1,917			2,261	17,338

ID	Scope Description	Labor	Material	Equipment	Disposal	Other	Contingency	Grand Total
		(in thousands)						
4.04	U1 Cold and Dark	9,470	4,687	549		1,548	2,438	18,692
4.05	U2 Cold and Dark	9,470	4,687	549		1,548	2,438	18,692
4.06	Security Modifications	9,495	1,210	762		26	1,724	13,216
5	**Site Infrastructure**	**$75,661**	**$31,751**	**$10,043**		**$5,129**	**$18,388**	**$140,972**
5.01	Offsite Infrastructure	11,029	9,330	4,277		938	3,836	29,411
5.02	Road Improvements	7,088	5,160	1,785		353	2,158	16,543
5.03	Facility Construction	14,437	7,647	2,038		871	3,749	28,742
5.04	Existing Building and Structure Modifications	9,789	4,470	1,224		2,326	2,671	20,481
5.05	ISFSI Security Building Construction	6,921	4,540	314		530	1,846	14,151
5.06	ISFSI Pad Expansion for GTCC Storage	11,259	604	405		110	1,857	14,235
5.07	Project Oversight and Support	15,139					2,271	17,410
6	**Large Component Removal (including waste/transportation)**	**$34,575**	**$4,971**	**$21,955**	[redacted]	[redacted]	[redacted]	**$166,370**
6.01	Legacy Steam Generators	4,598	314	3,345	[redacted]	[redacted]	[redacted]	45,872
6.02	Legacy Rx Heads	1,004	107	21	[redacted]	[redacted]	[redacted]	3,592
6.03	Steam Generators	16,741	1,167	15,692	[redacted]	[redacted]	[redacted]	78,506
6.04	Reactor Heads	468	353	528	[redacted]	[redacted]	[redacted]	4,614
6.05	Reactor Coolant Pumps	2,016	219	832	[redacted]	[redacted]	[redacted]	9,361
6.06	Pressurizers	503	310	539	[redacted]	[redacted]	[redacted]	4,215
6.07	Manipulators	224	84	512	[redacted]	[redacted]	[redacted]	1,024
6.08	Generators and Exciters	341	61	72	[redacted]	[redacted]	[redacted]	592
6.09	Main Turbines	986	154	167	[redacted]	[redacted]	[redacted]	1,633
6.10	Diesel Generators	296	255	31	[redacted]	[redacted]	[redacted]	728

ID	Scope Description	Labor	Material	Equipment	Disposal	Other	Contingency	Grand Total
		(in thousands)						
6.11	Other Turbine Building Components	2,542	1,586	182	[redacted]			5,387
6.12	Large Access Penetrations	88	141	35				329
6.13	Project Oversight and Support	4,769	219					10,517
7	**Reactor/Internals Segmentation**	**$56,203**	**$28,427**	**$11,082**	[redacted]			**$332,341**
7.01	U1 Internals Segmentation	7,358	3,007					17,308
7.02	U1 Reactor Segmentation	4,025	2,111	11				10,165
7.03	U2 Internals Segmentation	6,247	4,335	4				17,136
7.04	U2 Reactor Segmentation	3,338	1,457	11				8,353
7.05	Waste & Transportation	432		4,791				191,129
7.06	Project Oversight and Support	18,092	1,751	1,588				36,417
7.07	Specialty Equipment	16,710	15,766	4,676				51,833
8	**Spent Fuel Transfer to ISFSI**	**$35,482**	**$822**	**$9,643**		**$158,872**	**$30,723**	**$235,541**
8.01	SNF and GTCC Cask Procurement	963	572	1,278		154,612	23,614	181,039
8.02	U1 Spent Fuel Transfer to ISFSI	17,542	155	4,403		1,859	3,594	27,552
8.03	U2 Spent Fuel Transfer to ISFSI	13,898	76	2,641		1,647	2,739	21,003
8.04	U1 GTCC Transfer to ISFSI	1,697	9	792		608	466	3,574
8.05	U2 GTCC Transfer to ISFSI	1,381	9	528		145	310	2,374
9	**Turbine Building**	**$36,525**	**$4,763**	**$6,190**		**$3,069**	**$18,121**	**$68,667**
9.01	U1 Decontamination	12,037	658	957		15	6,833	20,500
9.02	U1 System & Area Closure	2,995	1,329	672		399	1,349	6,744
9.03	U1 Demolition	2,221	316	1,358		1,006	735	5,635
9.04	U2 Decontamination	10,791	658	957		15	6,210	18,630
9.05	U2 System & Area Closure	6,115	1,401	663		518	2,174	10,871

ID	Scope Description	Labor	Material	Equipment	Disposal	Other	Contingency	Grand Total
		(in thousands)						
9.06	U2 Demolition	2,366	401	1,584		1,116	820	6,287
10	**Auxiliary Building**	**$51,112**	**$9,086**	**$8,984**		**$5,414**	**$17,526**	**$92,122**
10.01	U1 Decontamination	1,773	139	66		1	990	2,969
10.02	U1 System & Area Closure	20,902	3,483	1,927		886	6,800	33,998
10.03	U1 Demolition	4,117	1,390	2,263		1,994	1,464	11,228
10.04	U2 Decontamination	1,075	139	66		1	640	1,921
10.05	U2 System & Area Closure	18,707	3,533	1,947		574	6,190	30,951
10.06	U2 Demolition	4,538	403	2,715		1,957	1,442	11,055
11	**Containment**	**$64,428**	**10,639**	**$12,742**		**$9,711**	**$23,492**	**$121,012**
11.01	U1 Decontamination	4,413	347	547		277	2,792	8,375
11.02	U1 System & Area Closure	20,772	3,508	1,312		1,133	6,681	33,407
11.03	U1 Demolition	7,427	1,382	4,525		3,434	2,515	19,283
11.04	U2 Decontamination	3,197	343	547		274	2,180	6,540
11.05	U2 System & Area Closure	21,064	3,630	1,286		1,129	6,778	33,888
11.06	U2 Demolition	7,556	1,428	4,525		3,464	2,546	19,519
12	**Fuel Handling Building**	**$25,274**	**$6,420**	**$4,460**		**$2,965**	**$9,509**	**$48,627**
12.01	U1 Decontamination	1,014	78	247		2	671	2,013
12.02	U1 System & Area Closure	8,399	2,201	849		475	2,981	14,905
12.03	U1 Demolition	2,103	1,373	1,358		1,237	911	6,982
12.04	U2 Decontamination	976	77	247		2	651	1,953
12.05	U2 System & Area Closure	11,479	2,305	854		594	3,808	19,040
12.06	U2 Demolition	1,302	386	905		655	487	3,735

ID	Scope Description	Labor	Material	Equipment	Disposal	Other	Contingency	Grand Total
		(in thousands)						
14	**Balance of Site**	**$43,332**	**$6,633**	**$16,680**		**$1,296**	**$12,760**	**$80,702**
14.01	Decontamination	7,148	115	75		2	3,670	11,011
14.02	System & Area Closure	8,292	2,448	755		821	1,847	14,163
14.03	Demolition	27,892	4,070	15,850		473	7,243	55,528
15	**Intake Structure**	**$14,893**	**$3,410**	**$11,391**		**$5,079**	**$6,880**	**$41,654**
15.01	System Area Closure	3,920	595	296		830	846	6,486
15.02	Coffer Dam	3,308	1,498	6,872		812	1,874	14,364
15.03	Demolition	7,665	1,317	4,223		3,437	4,161	20,804
16	**Discharge Structure**	**$6,060**	**$1,606**	**$3,660**		**$1,520**	**$2,275**	**$15,122**
16.01	Discharge Piping Decontamination	283	62	35			190	570
16.02	Coffer Dam	2,246	836	2,870		361	947	7,261
16.03	Demolition	950	245	515		446	539	2,696
16.04	System Area Closure	2,581	463	239		713	599	4,595
17	**Breakwaters**	**$14,922**	**$1,899**	**$91,621**	**$14,533**	**$106,086**	**$57,265**	**$286,326**
17.01	Demolition	14,922	1,899	91,621		2,687	27,782	138,910
17.02	Transportation					103,400	25,850	129,249
17.03	Disposal Cost				14,533		3,633	18,166
18	**Non-ISFSI Site Restoration**	**$62,568**	**$10,618**	**$14,269**		**$25,962**	**$21,658**	**$135,075**
18.01	Utilities and Structures Demo	7,656	850	3,626		15,302	4,115	31,549
18.02	Soil Remediation	2,193	172	667		573	541	4,145
18.03	Final Site Survey	25,061				5,911	9,291	40,263
18.04	Grading and Landscaping	27,658	9,596	9,976		4,176	7,711	59,118

ID	Scope Description	Labor	Material	Equipment	Disposal	Other	Contingency	Grand Total
		(in thousands)						
19	**Spent Fuel Transfer to DOE**	**$10,542**			**$7,517**	**$3,035**	**$3,164**	**$24,258**
19.01	U1 Spent Fuel Transfer to DOE	4,574				1,416	899	6,889
19.02	U2 Spent Fuel Transfer to DOE	5,308			7,517	1,416	2,136	16,376
19.03	GTCC Transfer to Offsite Facility	660				204	130	993
20	**ISFSI Demolition and Site Restoration**	**$27,114**	**$7,216**	**$7,057**		**$4,562**	**$9,007**	**$54,956**
20.01	Utilities and Structures Demo	12,190	713	3,491		2,543	4,734	23,671
20.02	Soil Remediation	1,347	47	206		180	267	2,048
20.03	Final Site Survey	1,073				400	442	1,915
20.04	Grading and Landscaping	12,505	6,455	3,359		1,439	3,564	27,322
	GRAND TOTAL	**$2,092,845**	**$184,370**	**$262,899**	[redacted]			**$4,802,395**

Below are summaries of each DCPP decommissioning Milestone:

(1) Program Management, Oversight, & Fees: This category includes general staff support and oversight, severance costs, metered energy usage, water and facility management, taxes, insurance fees, regulatory and industry fees, public engagement, radiological characterization, license termination preparation, emergency planning staffing and fees, and consumables. These costs are necessary decommissioning costs and they are not associated with a discrete scope of work.

(2) Security Operations: This category includes the general security staffing and associated departmental costs for the duration of the decommissioning project. The security modification costs are excluded from this category and are included in Power Block Modifications. Costs in this unassigned category will be submitted for reasonableness reviews at various phases in decommissioning project lifecycle. Each submission will represent a significant change in the staffing profile and associated departmental costs.

(3) Waste/Transportation: This category includes costs for transportation and disposal of all waste classifications excluding those associated with Breakwater Removal, Reactor/Internals Segmentation, and Large Component Removal. Waste costs associated with those scopes are easily segregated and can be allocated to their discrete projects. This category also includes material management costs which includes costs for managing the sale of remaining assets. Costs in this unassigned category will be submitted for reasonableness reviews at various phases in decommissioning project lifecycle. Each submission will represent a significant change in the waste production profile and associated costs.

(4) Power Block Modifications: This category includes the SFPI, cold and dark, and security modifications. These modifications are all implemented early in the project lifecycle and will allow PG&E to either reduce staffing levels or enhance the ability to safely execute decommissioning.

(5) Site Infrastructure: This category includes onsite and offsite infrastructure improvements required to complete decommissioning.

(6) Large Component Removal: This category includes removal of SGs, reactor heads, RCPs, main generator, main turbine, and other various large components that must be removed prior to demolition. This category also includes the transportation and disposal costs of the components.

(7) Reactor/Internals Segmentation: This category includes the RPV and internals segmentation along with the transportation and disposal costs. This scope of work is very specialized and includes the fabrication of custom tooling.

(8) Spent Fuel Transfer to ISFSI: This category includes the procurement of storage canisters/casks for both GTCC and spent fuel, the cost of loading spent fuel into casks, and transferring of all casks from the fuel handling building to the ISFSI pad. The loading of GTCC waste into casks can be found in the Reactor/Internals Segmentation scope.

(9) Turbine Building Removal: This category includes decontamination, system and area closure, and demolition of the Unit 1 and Unit 2 turbine building.

(10) Auxiliary Building Removal: This category includes decontamination, system and area closure, and demolition of the Unit 1 and Unit 2 auxiliary building.

(11) Containment Removal: This category includes decontamination, system and area closure, and demolition of the Unit 1 and Unit 2 containment buildings.

(12) Fuel Handling Building Removal: This category includes decontamination, system and area closure, and demolition of the Unit 1 and Unit 2 fuel handling building.

(13) Milestone 13: Originally included the scope to remove the radiological waste laundry facility. This scope has been rolled into the Balance of Site Removal scope due to the negligible impact to cost and schedule.

(14) Balance of Site Removal: This category includes decontamination, system and area closure, and demolition of all remaining common and unit specific structures.

(15) Intake Structure Removal: This category includes installing of a coffer dam inside the breakwater lagoon, system and area closure, removal of the intake structure, and removal of the coffer dam.

(16) Discharge Structure Removal: This category includes installing of a coffer dam around the discharge structure, decontamination, system and area closure, removal of the discharge structure, and removal of the coffer dam.

(17) Breakwater Removal: This category includes demolition, transportation, and disposal of the East and West breakwaters.

(18) Non-ISFSI Site Restoration: This category includes underground utility and structure demolition, soil remediation, final site survey, and final grading, landscaping, and re-vegetation of the non-ISFSI portion of the site.

(19) Spent Fuel Transfer to DOE: This category includes the transfer of spent fuel and GTCC casks to the Department of Energy.

(20) ISFSI Demolition and Site Restoration: This category includes underground utility and structure demolition, soil remediation, final site survey, and final grading, landscaping, and re-vegetation of the ISFSI portion of the site.

6.2. DISCRETE AND UNASSIGNED COST MILESTONES

Decommissioning costs include both discrete and unassigned costs. Discrete costs are those costs that can be directly attributed to a project with identified completion criteria such as Power Block Modifications and Large Component Removal. Discrete costs included in milestones include the resources necessary to complete the Project such as equipment, materials, and non-PG&E resources required to execute the Project throughout the decommissioning project lifecycle. PG&E classified costs as discrete costs when the start and finish of a specific scope of work could be identified. When developing the DCE, PG&E ensured that all discrete work scopes contain the resources necessary to complete the project and that those work scopes do not include any of the utility oversight costs that are captured in the Unassigned Costs Milestones. PG&E ensured that the Unassigned Cost Milestones only include the oversight required for the overall decommissioning project and no costs directly attributed to a discrete scope.

Waste, transportation, and material management costs are considered to be unassigned because the final handling and transportation of a waste shipment will likely include multiple discrete scopes of work (e.g., Turbine Building decontamination, Fuel Handling Building system area closure, and building demolition work will produce waste to be handled, transported, and shipped concurrently). This is not the case with all waste however; waste associated with Large Component Removal and Reactor/Internals Segmentation will be easily segregated from the general waste streams because the components are large or highly irradiated and require custom transportation and disposal. The Breakwater waste and transportation will also be easily segregated because the waste will be taken to a unique location for drying before transportation to a disposal facility. For this reason, waste and transportation for Large Component Removal, Reactor/Internals Segmentation, and Breakwater are not included in the Waste/Transportation/Material Management unassigned cost

Unassigned Milestones will be submitted for reasonableness reviews at the conclusion of certain identified decommissioning phases. Each phase represents a significant change in the staffing profile and associated costs.

Unassigned cost Milestones include: (1) Program Management, Oversight, & Fees; (2) Security Operations; and (3) Waste/Transportation/Material Management (excluding Reactor/Internals Segmentation, Large Component Removal, and Breakwater). These Milestones include necessary decommissioning expenses not attributed to a specific scope of work and support multiple scopes of discrete work that occur at varying time periods, as well as general project oversight. For these costs, there is no easily identifiable completion date, thus the Unassigned Costs are presented for reasonableness based on the completion of major decommissioning phases as shown in Figure 5-3 and summarized below. These phases are appropriate timeframes to evaluate cost reasonableness of Unassigned Costs as they reflect when either major regulatory requirement changes occur (e.g.

significant decreases in staffing) or major scopes of work are completed (e.g. all building demolition is completed).

- Pre-Planning Phase: The pre-shutdown planning time period from 2016 until Unit 1 shutdown in early November 2025. A significant severance in non-security staff will occur at this point in time.
- Power Block Modifications Phase: The period after unit 1 shutdown up until the Cold and Dark, Spent Fuel Pool Island, and Security modifications are complete. The completion of these modifications will drive a significant drop in security staffing levels.
- Wet Storage Phase: The period from completion of power block modifications to the completion of spent fuel transfers to ISFSI. Completion of this phase drives significant reductions in staffing related to management of wet fuel and security related to the protected area which will be eliminated (ISFSI protected area still remains).
- Building Demolition Phase: The period from completion of spent fuel transfers to the completion of all building demolition, excluding the breakwater. The completion of this period represents closure of a large portion of the non-radiological waste and nearly all radiological waste.
- Site Restoration Phase: The period from the building demolition phase to the completion of all non-ISFSI site demolition and restoration. This milestone signifies completion of the decommissioning project, excluding the ISFSI demolition which will not occur for another 30 years. This phase represents completion of the breakwater demolition which is a large portion of the non-radiological waste on site, and the final step down in staffing.
- ISFSI Operations Phase: The period between decommissioning of the plant site and the start of ISFSI demolition. This phase contains only security staffing at ISFSI and transfer of spent fuel and GTCC to the DOE. Completion of this phase represents the final step down in security staffing.
- ISFSI Restoration Phase: The period from which all spent fuel and GTCC are removed from ISFSI and the entire site is restored. This phase represents completion of decommissioning and project closure.

For unassigned Milestones, PG&E has grouped similar costs into several logical categories that support tracking and reporting of expenses.

6.3. REVIEW OF COMPLETED PROJECTS

6.3.1. Timing of Review

Costs and activities will be presented for reasonableness review in the NDCTP following completion of a discrete Milestone or, for unassigned Milestones, following completion of a defined major decommissioning phase.

To provide a predictable timeline for review of DCPP decommissioning activities and costs; Table 6-2 identifies anticipated completion dates and the NDCTP in which Milestones are projected to be reviewed.

Table 6-2: Expected DCPP Decommissioning Milestone Reasonableness Review Schedule

2024 NDCTP	Completion Date	Costs (2017$)
(1) Program Management, Oversight, Fees - Pre-Planning	2-Nov-24	$154,837
2027 NDCTP		
(4) Power Block Modifications Complete	27-Apr-27	$80,706
(1) Program Management, Oversight, Fees - Power Block Mods Phase	27-Apr-27	$325,433
(2) Security Operations - Power Block Mods Phase	27-Apr-27	$95,933
(3) Waste/Transportation/Material Management - Power Block Mods Phase	27-Apr-27	$20,179
2033 NDCTP		
(6) Large Component Removal & Waste Disposal Complete	23-Dec-31	$166,370
(15) Intake Demolition Complete	6-May-32	$41,654
(8) Spent Fuel & GTCC Waste Transfers to ISFSI Complete	24-Jun-32	$235,525
(1) Program Management, Oversight, Fees - Wet Storage Phase	24-Jun-32	$409,043
(2) Security Operations - Wet Storage Phase	24-Jun-32	$215,266
(5) Site Infrastructure Complete	7-Oct-32	$140,972
(9) Turbine Building Demolition Complete	27-Apr-33	$68,667
(7) Reactor/Internals Segmentation & Disposal Complete	29-Aug-33	$332,341
2036 NDCTP		
(16) Discharge Structure Demolition Complete	16-May-34	$15,122
(12) Fuel Handling Building Demolitions Complete	6-Jun-34	$48,627
(10) Aux Building Demolition Complete	13-Jun-34	$92,122
(11) Containment Building Demolitions Complete	14-Mar-35	$121,012
(1) Program Management, Oversight, Fees - Building Demo Phase	14-Mar-35	$202,796
(3) Waste/Transportation/Material Management - Building Demo Phase	14-Mar-35	$607,270
2039 NDCTP		
(14) Balance of Site Demolitions Complete	11-Mar-38	$80,702
(17) Breakwater Demolition Complete	9-Sep-38	$286,326
(18) Non-ISFSI Site Restoration Complete	7-Dec-38	$135,075

(1) Program Management, Oversight, Fees - Site Restoration Phase	7-Dec-38	$152,262
(3) Waste/Transportation/Material Management - Site Restoration Phase	7-Dec-38	$164,966
2069 NDCTP		
(1) Program Management, Oversight, Fees – ISFSI Operations	9-Aug-67	$188,622
(2) Security Operations – ISFSI Operations	9-Aug-67	$249,487
(19) Spent Fuel & GTCC Waste Transfers to DOE Complete	9-Aug-67	$24,258
2072 NDCTP		
(1) Program Management, Oversight, Fees – ISFSI Restoration	29-Jan-71	$29,068
(20) ISFSI Demolition & Restoration Complete	29-Jan-71	$54,956
(3) Waste/Transportation/Material Management - ISFSI Restoration Phase	29-Jan-71	$62,797

6.3.2. Comparison of Completed Work to Prior Estimate

At the Commission's directive (see Reference 6.1), in July 2017, PG&E met with representatives from the Commission's Energy Division and interested parties. PG&E provided a cost comparison in initial draft format which would provide sufficient detail to compare actual costs to previously approved estimates. PG&E obtained concurrence from the participating parties on the overall cost comparison table format. Table 6-3 is the cost comparison table format, which has been updated to reflect the Milestones PG&E has developed, and the format which will be used for the first DCPP Decommissioning reasonableness review in 2024. The Pre-Planning phase of Program Management, Oversight, and Fees will be the first and only reasonableness review in the 2024 NDCTP, represented by the area highlighted in yellow.

6.4. DECISION LOG

Commencing on the date of a final decision in the 2018 NDCTP adopting a site-specific DCE for DCPP, PG&E will maintain an ongoing Decision Log to track decisions relative to DCPP decommissioning activities. Since the current site-specific DCE was developed as a ground-up evaluation without reference to the prior DCE, PG&E made no decisions with respect to the prior DCE. The Decision Log will include any decisions pertaining to cost, scope, or timing that could affect a Milestone by plus or minus more than 10 percent.

The Decision Log will identify:

- Description of the decision
- Date decision was made
- Decision-maker
- Factors considered
- Alternatives considered

Table 6-3: DCPP Milestone Comparison to Two Prior NDCTP Estimates

				2018	2021	2024 NDCTP			
				A	B	C	D	E	F
ID	Phase	Scope Description		2018 NDCTP	2021 NDCTP	Nominal Spend through 2023	Estimate to Complete	Estimate at Complete	Delta from 2021 NDCTP (E - B)
				(in thousands)					
1	Program Management, Oversight, and Fees			$1,462,062					
	Pre Planning			**$154,837**					
		1.01	Staffing	$113,071					
		1.06	NRC Fees / Reviews	$13,576					
		1.10	Permits	$19,454					
		1.11	Future Land Use	$7,229					
		1.12	Spent Fuel Management Plan	$57					
		1.18	Public Outreach & Stakeholder Engagement	$1,450					
	Power Block Mods			$325,433					
	Wet Storage			$409,043					
	Building Demo			$202,796					
	Site Restoration			$152,262					
	ISFSI Operations			$188,622					
	ISFSI Restoration			$29,068					
2	Security Operations			$560,686					
	Power Block Mods			$95,933					
	Wet Storage			$215,266					
	ISFSI Operations			$249,487					
3	Waste/Transportation/Material Management (Excluding: Breakwater, RPV/RVI Segmentation, & Large Component Removal)			$855,211					

				2018	2021	2024 NDCTP			
				A	B	C	D	E	F
ID	Phase		Scope Description	2018 NDCTP	2021 NDCTP	Nominal Spend through 2023	Estimate to Complete	Estimate at Complete	Delta from 2021 NDCTP (E - B)
	Power Block Mods			$20,179					
	Building Demo			$607,270					
	Site Restoration			$164,966					
	ISFSI Restoration			$62,797					
4	Power Block Modifications			$80,707					
		4.01	U1 Spent Fuel Pool Island	$6,680					
		4.02	U2 Spent Fuel Pool Island	$6,090					
		4.03	Install 230kV Baywood Feed	$17,338					
		4.04	U1 Cold and Dark	$18,692					
		4.05	U2 Cold and Dark	$18,692					
		4.06	Security Modifications	$13,216					
5	Site Infrastructure			$140,972					
		5.01	Offsite Infrastructure	$29,411					
		5.02	Road Improvements	$16,543					
		5.03	Facility Construction	$28,742					
		5.04	Existing Building and Structure Modifications	$20,481					
		5.05	ISFSI Security Building Construction	$14,151					
		5.06	ISFSI Pad Expansion for GTCC Storage	$14,235					
		5.07	Project Oversight and Support	$17,410					
6	Large Component Removal			$166,370					
		6.01	Legacy Steam Generators	$45,872					
		6.02	Legacy Rx Heads	$3,592					
		6.03	Steam Generators	$78,506					
		6.04	Reactor Heads	$4,614					

				2018	2021	2024 NDCTP			
				A	B	C	D	E	F
ID	Phase	Scope Description		2018 NDCTP	2021 NDCTP	Nominal Spend through 2023	Estimate to Complete	Estimate at Complete	Delta from 2021 NDCTP (E - B)
		6.05	Reactor Coolant Pumps	$9,361					
		6.06	Pressurizers	$4,215					
		6.07	Manipulators	$1,024					
		6.08	Generators and Exciters	$592					
		6.09	Main Turbines	$1,633					
		6.10	Diesel Generators	$728					
		6.11	Other Turbine Building Components	$5,387					
		6.12	Large Access Penetrations	$329					
		6.13	Project Oversight and Support	$10,517					
7	Reactor/Internals Segmentation			$332,341					
		7.01	U1 Internals Segmentation	$17,308					
		7.02	U1 Reactor Segmentation	$10,165					
		7.03	U2 Internals Segmentation	$17,136					
		7.04	U2 Reactor Segmentation	$8,353					
		7.05	Waste & Transportation	$191,129					
		7.06	Project Oversight and Support	$36,417					
		7.07	Specialty Equipment	$51,833					
8	Spent Fuel transfer to ISFSI			$235,525					
		8.01	SNF and GTCC Cask Procurement	$181,039					
		8.02	U1 Spent Fuel transfer to ISFSI	$27,537					
		8.03	U2 Spent Fuel transfer to ISFSI	$21,001					
		8.04	U1 GTCC Transfer to ISFSI	$3,574					
		8.05	U2 GTCC Transfer to ISFSI	$2,374					
9	Turbine Bldg			$68,667					
		9.01	U1 Decontamination	$20,500					

				2018	2021	2024 NDCTP			
				A	B	C	D	E	F
ID	Phase	Scope Description		2018 NDCTP	2021 NDCTP	Nominal Spend through 2023	Estimate to Complete	Estimate at Complete	Delta from 2021 NDCTP (E - B)
		9.02	U1 System & Area Closure	$6,744					
		9.03	U1 Demolition	$5,635					
		9.04	U2 Decontamination	$18,630					
		9.05	U2 System & Area Closure	$10,871					
		9.06	U2 Demolition	$6,287					
10	Aux Building			$92,122					
		10.01	U1 Decontamination	$2,969					
		10.02	U1 System & Area Closure	$33,998					
		10.03	U1 Demolition	$11,228					
		10.04	U2 Decontamination	$1,921					
		10.05	U2 System & Area Closure	$30,951					
		10.06	U2 Demolition	$11,055					
11	Containment			$121,012					
		11.01	U1 Decontamination	$8,375					
		11.02	U1 System & Area Closure	$33,407					
		11.03	U1 Demolition	$19,283					
		11.04	U2 Decontamination	$6,540					
		11.05	U2 System & Area Closure	$33,888					
		11.06	U2 Demolition	$19,519					
12	Fuel Handling Building			$48,627					
		12.01	U1 Decontamination	$2,013					
		12.02	U1 System & Area Closure	$14,905					
		12.03	U1 Demolition	$6,982					
		12.04	U2 Decontamination	$1,953					
		12.05	U2 System & Area Closure	$19,040					

ID	Phase	Scope Description		2018 A 2018 NDCTP	2021 B 2021 NDCTP	2024 NDCTP C Nominal Spend through 2023	D Estimate to Complete	E Estimate at Complete	F Delta from 2021 NDCTP (E - B)
		12.06	U2 Demolition	$3,735					
14	Balance of Site			$80,702					
		14.01	Decontamination	$11,011					
		14.02	System & Area Closure	$14,163					
		14.03	Demolition	$55,528					
15	Intake Structure			$41,654					
		15.01	System Area Closure	$6,486					
		15.02	Coffer Dam	$14,364					
		15.03	Demolition	$20,804					
16	Discharge Structure			$15,122					
		16.01	Discharge Piping Decon	$570					
		16.02	Coffer Dam	$7,261					
		16.03	Demolition	$2,696					
		16.04	System Area Closure	$4,595					
17	Breakwater			$286,326					
		17.01	Demolition	$138,910					
		17.02	Transportation	$129,249					
		17.03	Disposal Cost	$18,166					
18	Non-ISFSI Site Restoration			$135,075					
		18.01	Utilities and Structures Demo	$31,549					
		18.02	Soil Remediation	$4,145					
		18.03	Final Site Survey	$40,263					
		18.04	Grading and Landscaping	$59,118					

				2018	2021	2024 NDCTP			
				A	B	C	D	E	F
ID	Phase	Scope Description		2018 NDCTP	2021 NDCTP	Nominal Spend through 2023	Estimate to Complete	Estimate at Complete	Delta from 2021 NDCTP (E - B)
19	Spent Fuel transfer to DOE			$24,258					
		19.01	U1 Spent Fuel Transfer to DOE	$6,889					
		19.02	U2 Spent Fuel Transfer to DOE	$16,376					
		19.03	GTCC Transfer to Offsite Facility	$993					
20	ISFSI Demolition and Site Restoration			$54,956					
		20.01	Utilities and Structures Demo	$23,671					
		20.02	Soil Remediation	$2,048					
		20.03	Final Site Survey	$1,915					
		20.04	Grading and Landscaping	$27,322					
	GRAND TOTAL			$4,802,395					

DECOMMISSIONING COST ESTIMATE REFERENCES

Chapter 1 References

1.1 Retirement of Diablo Canyon Power Plant, Implementation of the Joint Proposal, and Recovery of Associated Costs Through Proposed Ratemaking Mechanisms, Testimony, Attachment A – Joint Proposal Agreement. Application 16-08-006. Pacific Gas and Electric Company. August 11, 2016.
1.2 Decision Approving Retirement of Diablo Canyon Nuclear Power Plant. Decision D.18-01-022. California Public Utilities Commission. Issued January 16, 2018.
1.3 Nuclear Regulatory Commission Glossary. DECON. Publicly accessible at: https://www.nrc.gov/reading-rm/basic-ref/glossary/decon.html
1.4 Nuclear Regulatory Commission Glossary. SAFSTOR. Publicly accessible at: https://www.nrc.gov/reading-rm/basic-ref/glossary/safstor.html
1.5 Nuclear Regulatory Commission Glossary. ENTOMB. Publicly accessible at: https://www.nrc.gov/reading-rm/basic-ref/glossary/entomb.html
1.6 Maine Yankee Decommissioning Experience Report (1997 – 2004). EPRI, Palo Alto, CA: 2005. EPRI Report No. 1011734. Publicly accessible at: www.epri.com
1.7 Decommissioning Pre-Planning Manual. EPRI, Palo Alto, CA: 2001. EPRI Report No. 1003025. Publicly accessible at: www.epri.com

Chapter 2 References

2.1 State Water Resources Control Board Letter to Sharon Reilly, “Summary Information Related to Implementation of Executive Order D-62-02 Imposing Moratorium on Disposal of Decommissioned Materials into Class III Landfills and Unclassified Waste Management Units,” dated April 7, 2008.
2.2 California State Lands Commission Letter to Tom Jones from Jennifer Lucchesi, File Ref PRC 9347, dated November 21, 2018.

Chapter 3 References

3.1 California State Lands Lease No. PRC 9347.1 General Lease - Industrial Use, dated June 28, 2016.
3.2 Department of the Army. U.S. Army Corps of Engineers. Public Works Technical Bulletin No. 200-1-27. dated September 14, 2004.
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DECOMMISSIONING COST ESTIMTE ATTACHMENTS

Attachment A – Site History of Diablo Canyon Power Plant Units 1 and 2

DECOMMISSIONING COST ESTIMATE

DIABLO CANYON POWER PLANT

ATTACHMENT A –

Site History of Diablo Canyon Power Plant Units 1 and 2

OVERVIEW

This attachment provides a photographic history of the site beginning in the 1960s. Photographs are divided into three sections: pre-construction, during construction, and after construction is completed.

PRE-CONSTRUCTION VIEWS

Figure A-1

Site of the future Discharge Cove with the future DCPP powerblock location in the background.

Figure A-2

May 1969. Site of the future Intake Cove and East Breakwater.

Figure A-3

From left to right, the future sites of the Old Steam Generator Storage Facility, switchyards, Independent Spent Fuel Storage Installation (ISFSI), raw water storage reservoirs, and the power block down by the shoreline.

VIEWS DURING CONSTRUCTION

Figure A-4

July 1969. Unit 1 Containment, Turbine, and Auxiliary Building Excavations.

Figure A-5

February 1971. Unit 1 Containment (foreground, center), Turbine (background, right), and Auxiliary Building (background, left) construction in progress.

Figure A-6

May 1971. East Breakwater construction.

Figure A-7

June 1971. West Breakwater construction with an exterior of Tribar.

Figure A-8

1971. Discharge Structure Construction in progress.

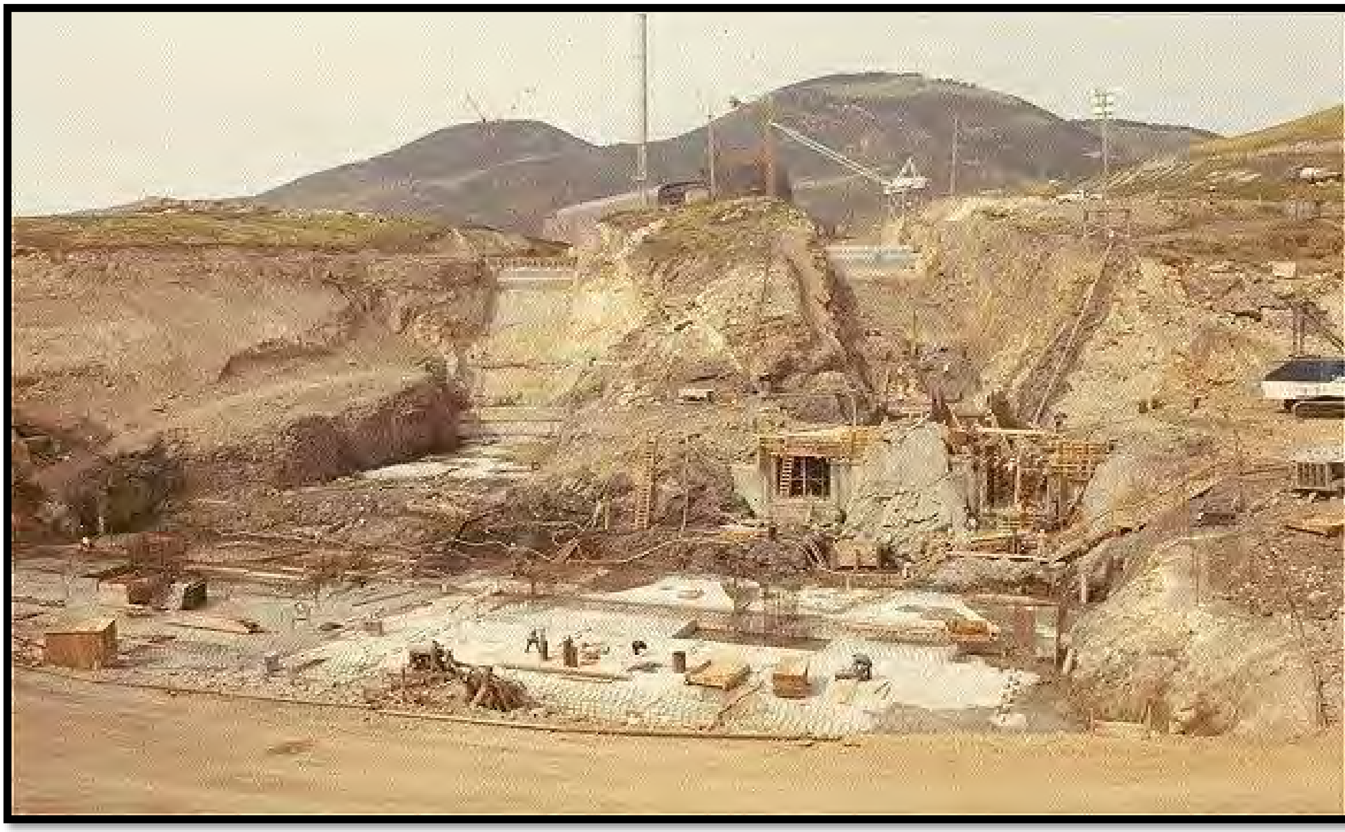
Figure A-9

June 1971. Construction of Unit 1 Turbine and Containment Buildings Discharge Structure in progress.

Figure A-10

1971. Unit 1 Containment structure (right-hand side), Auxiliary Building foundations (left foreground), and the Unit 1 portion of the Turbine Building structure (background) construction in progress.

Figure A-11



April 1972. Intake Structure construction in progress.

COMPLETED CONSTRUCTION

Figure A-12

DCPP site looking southeast with the ocean cooling water Discharge Cove in the foreground and the Intake Cove (enclosed by the two breakwaters) to the right of that. The two, gray concrete domes are the Containment Buildings (housing the reactors) with Unit 1 on the left and Unit 2 on the right. The long dark-brown structure in front of the Reactor Containment Buildings is the Turbine/Generator Building. The ISFSI is shown next to the raw water reservoirs further up the hill from the Containment Buildings.

Figure A-13

DCPP site looking north with the ocean cooling water Intake Cove in the foreground and the Discharge Cove behind that. The light-gray 6-floor building on this side of the Turbine/Generator Building is the Administration Building. The lower buildings in front of the Administration Building are the NPG Learning Center to the left (housing the Control Room Simulator) and the Cold Machine Shop to the right. The long light-gray building on the far right is DCPP's Warehouse.

Figure A-14

DCPP site looking south with the ocean cooling water Discharge Cove visible.

Figure A-15

Looking west at the DCPP site. The prominent building in the foreground is DCPP's Warehouse.

PACIFIC GAS AND ELECTRIC COMPANY

CHAPTER 4

ATTACHMENT B

G4S SPECIAL TACTICAL SERVICES REVIEW OF

DIABLO CANYON POWER PLANT

SECURITY DEFENSIVE STRATEGY

Subject: Decommissioning Security Modification, Security Strategy Assessment, February 12, 2018 – October 10, 2018.

This report documents the independent analysis for the proposed decommissioning defensive strategy at the Diablo Canyon Nuclear Generating Station. The independent analysis assesses the reasonableness of the use of the AVERT software, proposed modifications, number of security posts, overall defensive strategy, and provides recommendations/alternatives for improvement.

The independent analysis was performed by G4S Special Tactical Services (STS). STS provides a broad scope of services to the commercial nuclear industry since 2004. Using a "qualitative" versus "quantitative" analysis approach our assessment methodology is based on focused knowledge, deep experience, situational understanding, and expert understanding of past and current tactics, techniques, and procedures available to the Design Basis Threat (DBT) adversary.

STS consultant, Mr. Dan Williamson conducted the independent analysis. Mr. Williamson has conducted Protective Strategy reviews at numerous nuclear facilities, contributed to adjusting strategies after identifying efficiencies and margin, designed extensive barrier plans, provided on-site consultation about all aspects of the NRC's triennial Force on Force program, conducted exploitability analysis for unattended openings and safeguards violations; and supported the development and use of the AVERT system for nuclear specific design basis threat adversary and security force response.

For the independent analysis, Mr. Williamson performed site walk-downs and tabletop reviews to confirm the reasonableness of the application of AVERT, proposed modifications, projected number of security posts, and the overall defensive strategy. The independent analysis results were the basis for the enclosed recommendations for improvement and reasonableness determination of the decommissioning defensive strategy.

Use of AVERT

The AVERT 3D modeling and statistical analysis is being used to support the evaluation process described in SP-210, Protective Strategy Maintenance Program. SP-210 is the PG&E procedure that ensures the DCPP protective strategy meets the requirements of 10 CFR Part 73, Physical Protection of Plants and Materials. The AVERT 3D statistical analysis tool can be used for planning purposes and determining ideal locations for security positions and barriers. PG&E has conducted several runs in the AVERT system to identify the optimal and most efficient strategy. To validate the strategy is efficient, the PG&E staff conducted AVERT runs where the operator removes posts to validate the strategy breaking point. Based on the results of the AVERT runs, PG&E has identified the most efficient strategy while maintaining a high assurance to provide protection against radiological sabotage.

The AVERT tool will also be used to support the performance base analysis. One of the benefits of the AVERT 3D modeling tool is that multiple scenarios in multiple configurations can be ran prior to the plant shutdown. The AVERT results can be used to identify security posts and reduce the number of required performance-based drills and exercises to establish the optimal defensive strategy. Performance based drills have not yet been conducted.

The NRC has previously accepted use of the AVERT 3D modeling statistical analysis tool supported by the performance base data, limited scope drills, and tabletop drills when making changes to the security defensive strategy. The performance base data should be verified by the 3D statistical analysis. Several other utilities in the nuclear industry use the AVERT software to conduct strategy analysis and validate the reduction of security posts. This was very successful at Monticello Station. Monticello used the AVERT tool to reduce the number of security posts and identify the most efficient strategy. The NRC conducted performance-based testing during a Force-on-Force inspection. Monticello was successful in reducing several security posts with no issues identified by the NRC thanks to the AVERT system. PG&E is using the AVERT system similar to Monticello to identify the most efficient strategy.

Modifications

Protected area fence modifications

- This is a key modification to support the security position reduction. Several sites in the industry have had success with turbine grate delays added to the protected area (PA) fence.
- The design concept for the protected area fence is robust. Implementation of this modification will make it more difficult for the DBT adversary to enter the PA and access a target set.

  Recommendation/Alternative:
  - To enhance the design, recommend adding another section of turbine grate above the 4' kicker attached to the fence. This would be cost effective and further delay the DBT adversary.

Delay fence modification/relocation

- This is another key modification to support the security position reduction. The K-Rail system will keep the DBT adversary in security sectors of fire for a longer period of time allowing security to deter or stop the adversary prior to PA entry.

  Recommendation/Alternative:
  - Recommend conducting an evaluation to determine if implementing the K-Rail delay system prior to shut down would reduce a security post(s). Security post reductions prior to the shutdown could result in cost savings that would offset the cost of the modification.

Intake/discharge tunnel pathway modification

- This modification is key to converting to a mainly exterior strategy. This modification will allow security to reduce some interior response positions. If this modification is not implemented, security staffing levels may have to increase for interior response.

  Recommendation/Alternative: None

Delay cage install on turbine building, auxiliary building and fuel handling building doors

- This is a key security modification for internal response and defense in depth. The modification will reduce the internal strategy time to move into position and interdict an adversary upon entry. The modification will also give the external responders more time to engage an adversary attempting to breach the delay cages.

- The modification will also give security multiple opportunities to engage an adversary from the interior and exterior. This barrier, in conjunction with the protected area fence and delay fencing listed above, will reduce the likelihood of an adversary gaining access to a target set location.

  Recommendation/Alternative: None

Removal of the 140' admin-turbine building bridge

- The pedestrian bridge between the administration building and the turbine building is a potential adversary pathway. With the bridge removed, an adversary will be forced to attempt to reach target set locations from the ground level. Removal of the bridge will facilitate early detection of a potential adversary and give security a high assurance of neutralizing the threat prior to reaching target set locations.

  Recommendation/Alternative: None

Remove overhead utilities that are de-energized

- Compensatory measures are required until de-energized overhead lines are removed. Removing de-energized overhead lines will eliminate a potential pathway for an adversary and the costs associated with implemented compensatory measures.

  Recommendation/Alternative: None

Remove siding from Unit 1 and Unit 2 Buttresses

- This modification improves the line of sight for early detection of a potential adversary. This modification combined with the external delays will result in more efficient security operations, and reduced security staffing levels while maintaining a high assurance of the ability to detect and neutralize an adversary.

  Recommendation/Alternative: None

Move main warehouse out of the main protected area.

- The benefit of moving the main warehouse outside the PA would be that other plant workers who need to access the warehouse could do so without the support of security. This modification does not appear to have an appreciable impact on security operations nor will it provide much value for reducing security staffing or improving the overall effectiveness of the defensive strategy.

  Recommendation/Alternative:

  - Recommendation: Determine the cost benefit of moving the warehouse prior to eliminating the Main PA fence.
  - Alternative: Install a delay fence between the warehouse and the admin building to

provide additional time to detect and neutralize an adversary at the delay fence. Retaining the existing configuration of the PA fence will save money and the proposed delay fence will facilitate early detection of a potential adversary.

Construct fighting positions in 100 Aux Unit 1 and Unit 2.

- The fighting positions will provide protection for internal responders from a DBT adversary. The fighting positions will maintain a good defense in depth and a continued high assurance of neutralizing the DBT adversary.

  Recommendation/Alternative: None

Seal doorways not used for decommissioning.

- These modifications will provide choke points and predictable routes of travel for a potential adversary. This makes executing the internal response easier and more effective for the security force. With fewer travel routes to target set locations, security will be able to execute the defensive strategy with fewer responders.

  Recommendation/Alternative: None

Security Staffing

A review of the security staffing approach using the AVERT 3D modeling system was performed. Security is using a good approach to ensure the system is used to its full potential. Once scenarios are run in the AVERT system, security conducts a "sensitivity analysis" to evaluate the results and identify any potential vulnerabilities that should be mitigated/eliminated.

Use of the AVERT results, in conjunction with performance base analysis using limited scope and table top drills will facilitate identification of the security staffing necessary to successfully protect the plant. The results will also provide a strong basis to support the evaluation process described in SP-210.

PG&E has identified the correct (minimum) number of security posts to ensure protection of the plant per requirements of 10 CFR Part 73, Physical Protection of Plants Materials. Currently during Period 1, the projected number of armed officers will increase because of compensatory measures that are needed for shutting down plant equipment. There is a steady reduction for each subsequent Period. If the Period 1 modifications are completed prior to transitioning to Period 2, consideration should be given to implementation of the Period 2 staffing strategy. Security would still need staffing levels to be higher than the final Period 2 numbers to support ongoing work within the protected area; such as vehicle searches, escorts, and compensatory measures.

A good practice is that the decommissioning security staffing projections have taken into consideration the use of operating experience from other sites. One mistake other sites have made is reducing too many security force members then realizing work cannot be supported. Re-staffing can be a costly process.

Overall Defensive Strategy

The proposed defensive strategy with the installation of modifications outlined in the plan will allow security to detect and neutralize an adversary prior to reaching target set locations. The strategy also provides a good defense in depth in case of unauthorized entry of an adversary. With the use of AVERT system along with the performance base evaluation data, DCPP will have a strong strategy with a strong documentation basis to support the evaluation process and strategy described in SP-210. Based on the assessment conducted, the proposed decommissioning defensive strategy will Not result in the loss of high assurance that adequate protection can and will be taken in the event of a security emergency as required by 10 CFR 73.

Other considerations

- Add the Removal of the Instrument and Control Building (Building 102) on the west side of the main PA. Removal of Building 102 as soon as possible will reduce the cover and concealment of a DBT adversary and open sectors of fire immediately.
- Evaluate the reuse/relocation of existing security equipment to incorporate into the shutdown and ISFSI strategies to determine if more cost savings can be found.
- Develop a chart or figure to show the potential return on investment for the money spent for the security modifications. This will help explain how changes in the defensive strategy and/or modifications will pay for itself or provide a cost savings.
- Describe who will lead and/or conduct the site walk-downs (engineering, operations, security, maintenance, etc.) to ensure security is present for every walk-down. There is operating experience of security not being present during walk-downs and decisions made that impact security. In one case, the decision made would have cost the site two additional security positions added to the strategy. This issue was identified and resolved on the final walk-down when security was present. If security was involved in all walk-downs, this issue would have been identified much sooner.

Summary

The decommissioning defensive strategy is well thought out and is reasonable. The site has put a strong emphasis on the use of operating experience from other utilities that have gone through the decommissioning process. Based on the defensive strategy, the overall gains in efficiencies could result in cost savings that would offset the total cost of the implementing the programmatic and physical security changes.

PG&E's use of the AVERT results, in conjunction with performance base analysis using limited scope and table top drills is the best approach to identify the security staffing necessary to successfully protect the plant during decommissioning and storage of fuel at the ISFSI. In addition, the proposed modifications will improve security response times, reduce interior response positions, and reduce the likelihood of an adversary gaining access to a target set location.

Based on the information reviewed during the independent analysis, the recommendations and alternatives described in the report will enhance the defensive strategy and/or provide additional cost savings.

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