

NUCLEAR POWER GENERATION  
DIABLO CANYON POWER PLANT  
SELF PACED (WBT) GUIDE AND STUDENT HANDOUT

PROGRAM:	<b>MECHANICAL MAINTENANCE PERSONNEL AND SUPERVISOR</b>	COURSE No.:	<b>N/A</b>
COURSE:	<b>NON-MECHANICAL SPECIFIC</b>	TOPIC No.:	<b>N/A</b>
TOPIC:	<b>OTHER NMS TRAINING</b>	LESSON No.:	<b>MSFMEW</b>
LESSON:	<b>FOREIGN MATERIAL EXCLUSION WORKER</b>		
APPROXIMATE TIME FOR INSTRUCTION:	<b>5 HOURS</b>		

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## Instructor Materials

1. Lesson guide
2. AD4.ID6, Foreign Material Exclusion Program

## Student Materials

1. Lesson Guide/Student Handout
2. Current Revision of AD4.ID6, Foreign Material Exclusion Program

## Lesson References

1. Lesson MS0059, Foreign Material Exclusion Program (FME Monitor Training)
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## Remarks

1. This lesson covers worker responsibilities in regards to the DCPD FME program.
    - This lesson also contains a “Current Issues” section.
    - This lesson is to be presented as CBT.
  2. This revision is tracked by TIP #21233 that documents editorial corrections based on CBT feedback, and AD4.ID6 revision. See revision bars.
  3. “SOER 95-1, Reducing Events Resulting from Foreign Material Intrusion”, applicable philosophy of this SOER has been incorporated into IDAP AD4.ID6, “Foreign Material Exclusion Program”.
  4. TIP #18200, OE23463 - Failed Dead Blow Hammer and Loss of FME Integrity (Wolf Creek), incorporated into Current Issues segment of lesson.
  5. This lesson is intended to assist personnel assigned to work on plant equipment to recognize management FME program expectations, use of Human Performance Error Prevention Tools, and their responsibilities as a FME Worker. This lesson is not intended to allow personnel to perform work as a FME Monitor. Before working as a FME Monitor personnel must satisfactorily complete the FME Program training (MS0059).
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REV. 4

## Objectives

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### Terminal Objective

Upon completion of this lesson, the student will serve as a Foreign Material Exclusion (FME) worker and take appropriate preventive measures to preclude the potential for inadvertent introduction of foreign material into plant systems or components in accordance with AD4.ID6, Foreign Material Exclusion Program.

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### Enabling Objectives

Number	Enabling Objective Description
1	State the objective and goal of the Foreign Material Exclusion Program.
2	Define terms associated with FME.
3	Identify the FME Worker and other FME personnel responsibilities.
4	Discuss the DCPD Site Standards Handbook expectations for FME.
5	Describe the implementation requirements for an FME plan.
6	Describe the guidelines for FME area covering and posting.
7	Discuss requirements for loss of integrity actions.
8	Describe the "Material Accountability Control" requirements that apply to all High Risk FME areas.
9	Identify items and activities that require special controls in or near High Risk FME areas.
N/A	Current Issues

**End of Objectives**

## Introduction

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**Purpose** The purpose of this lesson is to identify practices and procedures used to prevent introduction of foreign materials into systems and equipment when performing FME “Worker” duties.

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**Applicability** This lesson is not intended to allow personnel to perform work as a FME “Monitor”. Before working as a FME “Monitor” personnel must satisfactorily complete additional training.

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*End of Introduction*

## Foreign Material Exclusion Worker

### Objective & Goal of the FME Program

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**Objective 1** State the objective and goal of the Foreign Material Exclusion Program.

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**Need to Know  
FME  
OBJECTIVE &  
Goals**

The **objective** of the FME program is to take appropriate precautions to minimize the potential for inadvertent introduction of foreign material into plant systems or components.

We want you to have a “**Focus on Prevention**”.

*You need to:*

- *RECOGNIZE when you are about to perform an activity that can generate foreign material.*
- *Use a CAREFUL, THOUGHTFUL, PROFESSIONAL APPROACH and think through the activities you intend to perform.*
- *Take adequate precautions to prevent an introduction of foreign material into any system or component.*

*All foreign material that is created shall be CAPTURED/CONTAINED. The approach of “CLEANING UP AFTERWARDS” is not acceptable*

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**Procedure** The plant procedure for FME controls that we will be referring to throughout this lesson is AD4.ID6.

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**Nice to Know  
Housekeeping**

- Good Housekeeping is our first line of defense for preventing the intrusion of foreign materials in or on our equipment and systems.
- Housekeeping is the responsibility of all station organizations.
- You must “CLEAN AS YOU GO” to prevent poor housekeeping.

Clean As You Go: Includes cleaning up foreign material such as machining, grinding, welding, or cutting, while those activities are in progress in addition to at the end of the task

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## Objective & Goal of the FME Program, Continued

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### Nice to Know

#### Effect On Plant

Foreign material in plant systems and components can cause:

- Fuel damage.
- Component malfunction or failure.
- Increased radiation levels.
- Increased radioactive waste.
- Changes in system performance characteristics.

The net result could be:

- Decreased plant safety and reliability.
- Unnecessary work.
- Increased maintenance costs.
- Unwarranted radiation exposure.

**Example of poor FME management: Fuel assembly during DCPD 2R14 showing failed fuel rod caused by debris induced fretting (wear).**



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## Common Industry FME Errors (SOER 95-1)

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### Introduction

*The following material comes from a nuclear industry event report that covers common FME problems found at Nuclear stations.*

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### Common Problems

*Most events involving foreign material intrusion result from weaknesses in the following areas:*

- Using band saws to cut into piping systems. They can introduce a large amount of small metal particles not easily removed from the system.
  - Using tools that are **not** in good repair that can have pieces fall into open systems. Examples:
    - wire brushes with loose bristles
    - chisels with mushroomed heads
    - tools with loose parts
  - Not installing plugs in piping and components during machining and grinding activities.
  - Not installing temporary covers on openings in equipment and systems during periods when no work is in progress.
  - Not removing debris, tools, and material from the work area prior to reassembling equipment or closing systems
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### Insufficient Guidance

Workers sometimes receive insufficient guidance for implementing the FME program due to the following:

- The work plan does **not** address the need for FME controls.
  - Work plans provide insufficient direction for when and how to establish FME boundaries or zones.
  - Work plans do **not** adequately define the work practices to be used
  - Work plans lack inspection and accountability requirements
  - Post-work inspection requirements for system cleanliness are not thorough.
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## Common Industry FME Errors (SOER 95-1), Continued

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### Not Familiar with requirement

Workers performing a task were **not** familiar with the station requirements for FME controls which include.

- Failure to implement tool inventory controls.
- Contractors **not** familiar with station FME requirements or good industry practices.
- Personnel, aware of foreign materials having been introduced into a system or component fail to notify their Supervisor.
- Expectations are typically **not** sufficiently reinforced in training and during work activities

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### SOER 95-1 continued

#### In Summary

The most common causes of foreign material intrusion events are:

- Insufficiently established and communicated management expectations for the implementation of FME controls.
- Limited supervisory emphasis on FME considerations and practices during pre-job briefings and monitoring of work activities.
- Insufficient training of workers in basic FME practices and lack of specific FME training for work activities involving specialized activities or key plant systems.

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### Practice / Feedback

The objective of the FME program is to take the approach of “CLEANING UP AFTERWARDS” to prevent the potential for inadvertent introduction of foreign material into plant systems or components.

- A. True
- B. False**

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*End of Objective 1*

## FME Definitions

**Objective 2** Define the terms associated with FME.

**Need to Know** The following terms and their definitions are used in the FME program.

Term	Definition	Example or Condition
<b>Foreign Material</b>	Material that <b>IS NOT</b> part of the plant equipment as designed. <i>("Material" may be solid/liquid/gas)</i>	<ul style="list-style-type: none"> <li>• Dirt</li> <li>• Debris</li> <li>• Broken or loose parts.</li> <li>• Oil or lubricant</li> <li>• Rags</li> <li>• Machine tailings.</li> <li>• Grinding particles.</li> <li>• Tools</li> <li>• Paint chips.</li> <li>• Weld Slag</li> <li>• Lapping compound.</li> <li>• Other items that could affect equipment operation or system chemistry.</li> </ul>
<b>FME Area</b>	An equipment breach or work area requiring special controls to prevent inadvertent entry of foreign material into plant equipment.	<ul style="list-style-type: none"> <li>• Open Valves</li> <li>• Open piping</li> <li>• Removed pipe spools</li> <li>• Reactor cavity during refueling</li> <li>• Turbines</li> <li>• Spent fuel pools</li> <li>• Panels</li> <li>• Relays</li> <li>• Handholes and manways.</li> <li>• Containment Recirc Sumps</li> <li>• Rx head instrument port gaps.</li> <li>• Generators</li> <li>• Switchgear</li> <li>• Computers</li> <li>• Instrument Transformers</li> </ul>

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## FME Definitions, Continued

Term	Definition	Example or Condition
<b>FME Barrier</b>	An internal or external device, cover, or shield installed to prevent foreign material entry into equipment.	FME barriers include: <ul style="list-style-type: none"> <li>• Component parts, such as valve bonnets, diaphragms, manway covers.</li> <li>• Temporary covers, such as tents, glove bags, pipe dams, fabricated covers.</li> <li>• Temporary Curtains or Walls.</li> </ul>
<b>FME Boundary</b>	A physical or imaginary boundary around a job or area	<ul style="list-style-type: none"> <li>• The FME boundary <b>MAY</b> include a barrier to prevent entry of foreign material into the area.</li> <li>• FME boundaries <b>MAY</b> consist of rope, curtains, tents, temporary walls, fencing, FME tape markers, or other similar materials.</li> </ul>
<b>Disposable Items</b>	Items that enter the FME area as bulk consumables, are used inside the FME area, and are disposed of at the work site.	<ul style="list-style-type: none"> <li>• Disposable gloves</li> <li>• Wipe-all</li> <li>• Rags</li> <li>• Ty-Wraps</li> </ul>
<b>Buffer Zone</b>	An area established immediately adjacent to critical or sensitive Foreign Material Exclusion Areas (FMEA) as appropriate or practicable. This zone is maintained free from material having a potential of being tracked, blown, or falling into the Foreign Material Exclusion Area (FMEA).	<ul style="list-style-type: none"> <li>•</li> </ul>
<b>Lanyard</b>	A device used to hold or fasten a tool, material, or other item thus preventing its loss.	Lanyards are generally made from rope, cord, or some other suitable restraint and can be used to attach an item to a secure attachment point.

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## FME Definitions, Continued

Term	Definition	Example or Condition
<b>Equipment</b>	Plant systems or components	<ul style="list-style-type: none"> <li>• Piping</li> <li>• Tubing</li> <li>• Pumps</li> <li>• Valves</li> <li>• Instruments</li> <li>• Pools</li> <li>• Vessels</li> <li>• Electrical panels or cabinets</li> <li>• Cavities</li> <li>• Heat Exchangers</li> </ul>
<b>Equipment Breach</b>	An opening through which foreign material can enter equipment. Breaches include physical openings in mechanical systems and cases where the interior of instrumentation, including Measuring and Testing Equipment (M&TE) or electrical equipment is exposed.	Examples include, switchgear cabinet door opened, cover to an electrical enclosure removed.
<b>Fail-safe</b>	A condition that ensures foreign material cannot:	<ul style="list-style-type: none"> <li>• Enter equipment <b>OR</b></li> <li>• Be inadvertently left in equipment.</li> </ul>
<b>Fail-safe Item</b>	<p>An item that meets <b>one</b> of the following criteria:</p> <p>☞</p> <p><b>NOTE:</b> Logging of some items meeting this definition may be required.</p>	<ul style="list-style-type: none"> <li>• Is too large to fit through the equipment breach.</li> <li>• Is securely attached to the person or to a secure object external to the FME area, such that it <b>cannot</b> be lost in the FME area.</li> <li>• Is contained in a container, such as a bag or box that is fail-safe.</li> <li>• For the Reactor Cavity and Spent Fuel Pool FME areas, is determined to be fail-safe by comparison to an authorized "fail safe gauge".</li> </ul>
<b>Clear Plastic</b>	Plastic material that is not color tinted or opaque.	<ul style="list-style-type: none"> <li>• Plastic sheeting.</li> <li>• Plastic Sleeving.</li> <li>• Plastic Wrappers.</li> <li>• Plastic bags.</li> <li>• Clear plastic Hose.</li> </ul>

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## FME Definitions, Continued

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**Practice /  
Feedback**

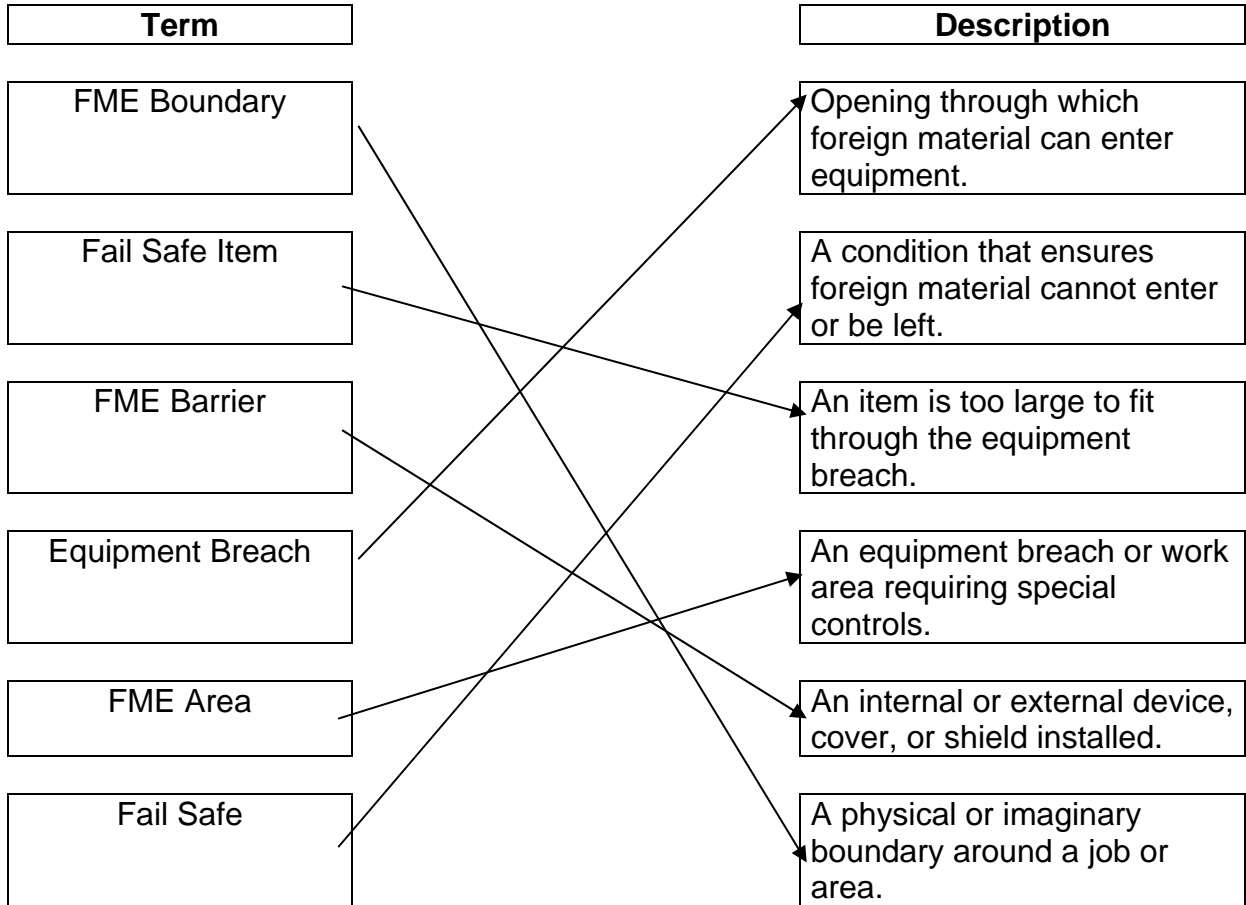
Connect the term in the left column to the correct description in the right column. (answer on next page)

Term	Description
FME Boundary	Opening through which foreign material can enter equipment.
Fail Safe Item	A condition that ensures foreign material cannot enter or be left.
FME Barrier	An item is too large to fit through the equipment breach.
Equipment Breach	An equipment breach or work area requiring special controls.
FME Area	An internal or external device, cover, or shield installed.
Fail Safe	A physical or imaginary boundary around a job or area.

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# FME Definitions, Continued

**Answer to Practice / Feedback**



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## FME Definitions, Continued

Term	Definition	Example or Condition
<b>FME Level</b>	Either Standard Risk or High Risk FME controls.	
<b>FME Plan</b>	A detailed plan included in the work package for projects requiring High Risk FME controls.	
<b>Standard FME Area</b>	An equipment breach or work area where foreign material <b>is not</b> easily identifiable and retrievable.	
<b>High Risk FME Area</b>	<p>An equipment breach or work area in which:</p> <ul style="list-style-type: none"> <li>• A closeout inspection may not identify <b>all</b> foreign material</li> </ul> <p><b>OR</b></p> <ul style="list-style-type: none"> <li>• Foreign material retrieval is impossible or very difficult</li> </ul> <p>NOTE: This type of FME area requires "Material Accountability Controls"</p>	<ul style="list-style-type: none"> <li>• Motors</li> <li>• Spent fuel pools.</li> <li>• Main generators.</li> <li>• Steam generators.</li> <li>• Turbine stop valves.</li> <li>• RCS first off check valves.</li> <li>• Rx Cavity during refueling.</li> <li>• Containment Recirc sumps.</li> <li>• Piping system breach, in or close to a downward vertical piping run, if an effective internal inspection cannot be performed.</li> </ul>
<b>Material Accountability Controls</b>	Physical or administrative controls taken to:	<ul style="list-style-type: none"> <li>• Account for items entering or exiting an FME area.</li> <li>• Prevent introducing foreign material into plant equipment.</li> </ul>
<b>Material Accountability Log</b>	A listing of items brought into an FME area. The types of logs used are: 	<ul style="list-style-type: none"> <li>• Personnel Entry Log (PEL)</li> <li>• Material Accountability Log (MAL)</li> </ul>

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## FME Definitions, Continued

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**Practice /  
Feedback**

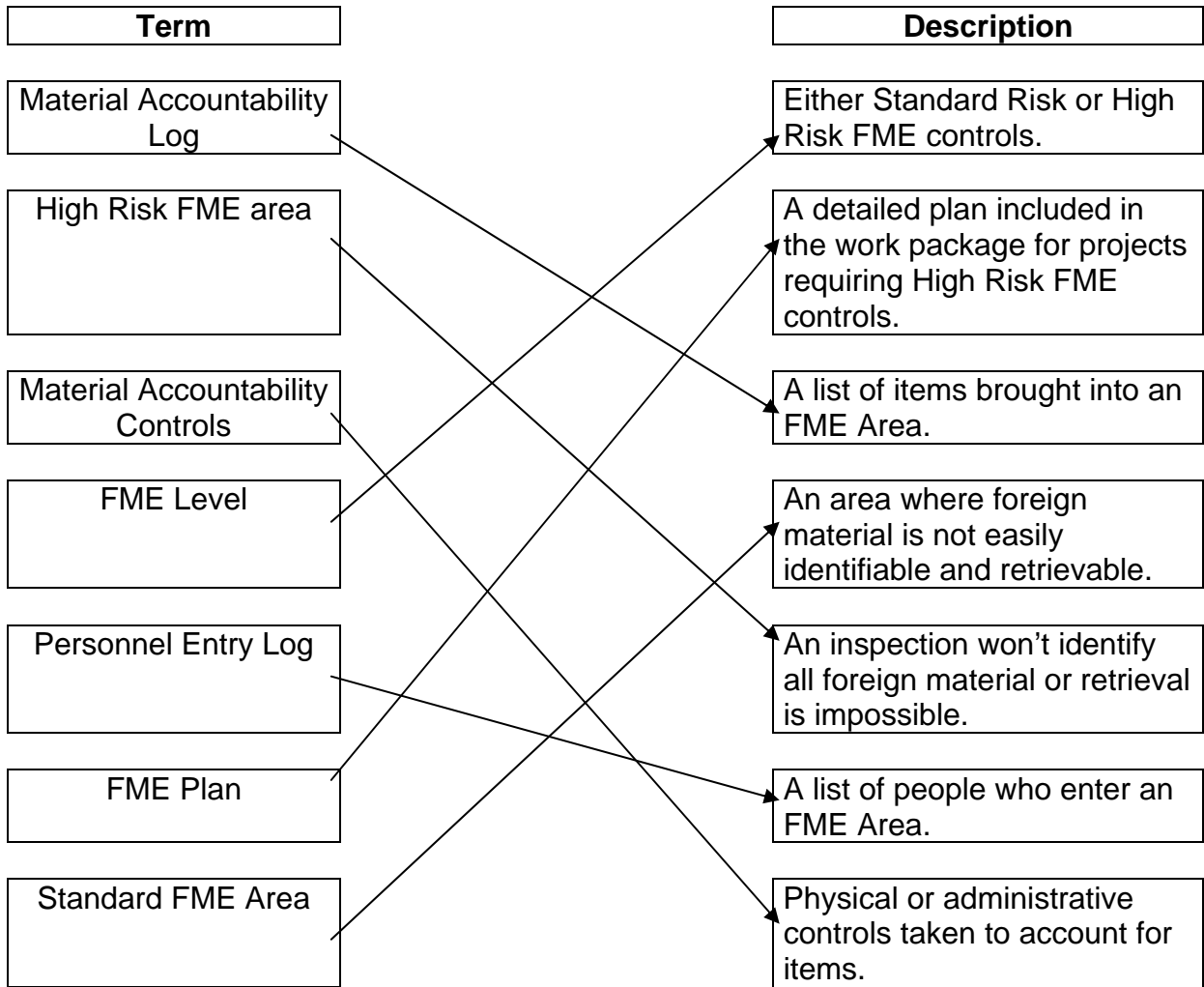
Connect the term in the left column to the correct description in the right column. (answer on next page)

Term	Description
Material Accountability Log	Either Standard Risk or High Risk FME controls.
High Risk FME area	A detailed plan included in the work package for projects requiring High Risk FME controls.
Material Accountability Controls	A list of items brought into an FME Area.
FME Level	An area where foreign material is not easily identifiable and retrievable.
Personnel Entry Log	An inspection won't identify all foreign material or retrieval is impossible.
FME Plan	A list of people who enter an FME Area.
Standard FME Area	Physical or administrative controls taken to account for items.

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# FME Definitions, Continued

**Answer to Practice / Feedback**



*End of Objective 2*

## FME Personnel Responsibility

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**Objective 3** Identify the FME worker and other FME personnel responsibilities.

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**Need to Know Responsibility**

All personnel share a common responsibility for Foreign Material Exclusion.

Any person may have work stopped if FME integrity becomes, or is in danger of becoming, compromised (notify supervision immediately).

Personnel	Responsibility
<b>FME Worker</b>	<ul style="list-style-type: none"> <li>Qualified worker responsible for implementing FME activities in the field per plant procedure..</li> </ul>
<b>FME Monitor</b>	<ul style="list-style-type: none"> <li>Controls access to the FME Area using material accountability controls and has the authority to prevent access or stop work when appropriate.</li> </ul>
<b>FME Supervisor</b>	<ul style="list-style-type: none"> <li>Establishes, maintains and closes out FME areas and notifies the appropriate personnel of a loss of FME integrity.</li> <li>Performs pre job briefs on the specific FME requirements before start of work and ensures you are qualified for FME work assigned.</li> </ul>
<b>FME Coordinator</b>	<ul style="list-style-type: none"> <li>Assists organizations with implementation of FME Program and evaluates FME Program effectiveness.</li> </ul>

**Practice / Feedback**

As an FME Worker, if you suspect a loss of FME integrity who should you inform?

- A. The FME Coordinator
- B. The Plant Manager
- C. The FME Supervisor for the FME**
- D. The Maintenance Manager

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*End of Objective 3*



## FME Program Requirements

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### Objective 4 Discuss the DCPD Site Standards Handbook expectations for FME.

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#### Need to Know

#### DCPD Site Standards Handbook (Red Book)

You shall take appropriate actions to prevent the introduction of foreign material into plant systems and components. The principles of FME is a behavior that focuses on prevention. Your responsibilities include:

- Know whether your job requires FME controls.
  - Understand the FME plan.
  - Perform, or notify the appropriate personnel to perform, FME inspections.
  - Set up, maintain and/or adhere to FME boundaries and barriers.
  - Document results of FME inspections.
  - Notify the appropriate supervisory personnel if a loss of FME integrity occurs.
  - Label and/or post FME areas and barriers.
  - Personnel entering an FME area shall:
    - Empty outer pockets on clothing or seal with tape, Velcro, etc.
    - Secure eyeglasses, earplugs, badges, and dosimetry using lanyards.
    - Log into the FME area as required.
  - Re-assess FME plan when conditions change.
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#### Human Performance and FME

The following list of Human Performance Error Prevention Tools are not all inclusive, but they give you a good starting point:

- Task Preview – prior to the Pre-job brief and starting the job identify FME intrusion concerns.
  - Pre-job brief – participate in the Pre-job brief and discuss solutions to prevent any identified FME intrusion possibilities.
  - Questioning Attitude – utilize this when there is any confusion or doubts. Stop all activities if unsure and contact supervision.
  - Two Minute Rule and Job Hazard Analysis – These tools can help you identify and prevent FME intrusion concerns on the job.
  - Maintain situational awareness for job duration – unexpected or unplanned issues can happen. Maintain focus & prevent FME intrusion concerns.
  - Self-Checking – continually use this technique to ensure you are not challenging your FME plan.
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## FME Program Requirements, Continued

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**Practice /  
Feedback**

The DCPD Site Standards Handbook includes expectations for personnel working in and around FME areas. All of the following are included "**EXCEPT**":

- A. Set up, maintain and/or adhere to FME boundaries.
- B. Know who the FME planner for the job is.**
- C. Know whether your job requires FME controls.
- D. Understand the FME plan.

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*End of Objective 4*

# FME Program Requirements

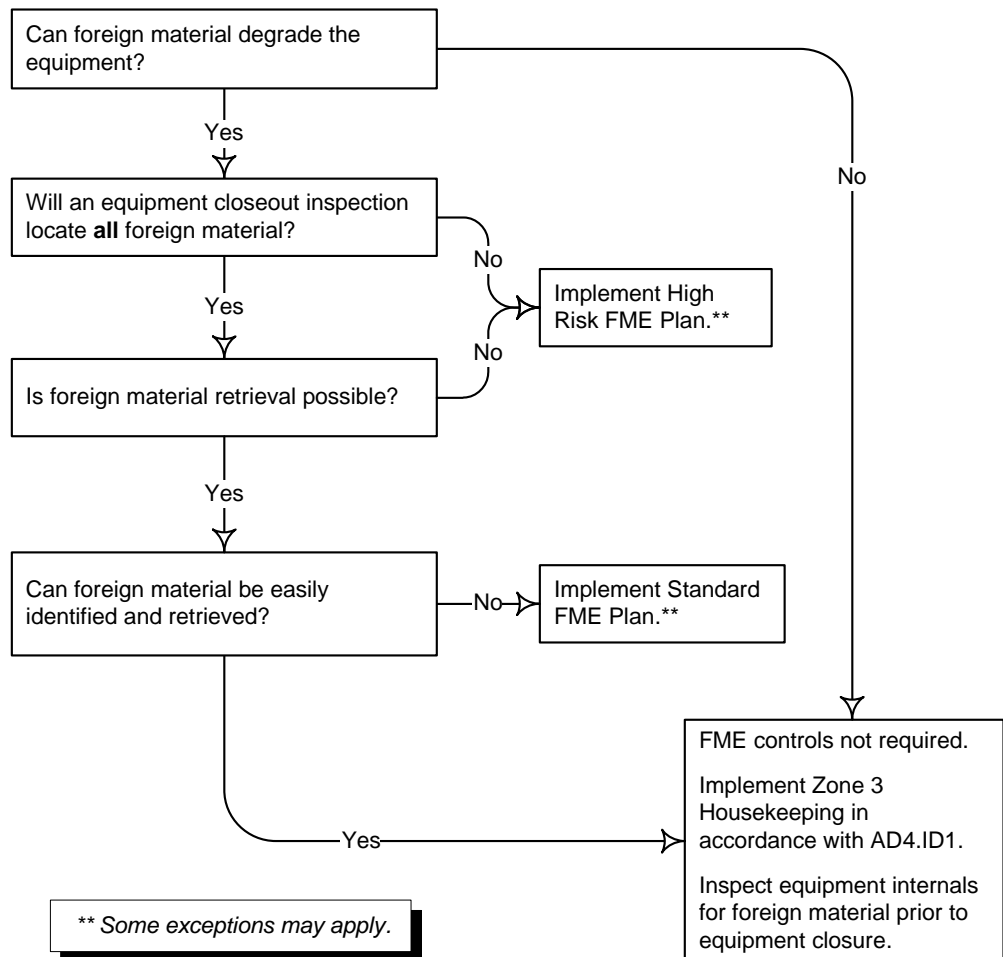
**Objective 5** Describe the implementation requirements for an FME plan.

**Introduction** Responsibilities for a successful FME plan rests with planners, supervisors and workers. Each of us has specific duties to perform.

**Need to Know** The work planner evaluates maintenance work and writes FME requirements into work packages.

**Nice to Know** The following decision making flowchart demonstrates the process used in selecting the appropriate FME level:

**Implementation Process**



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## FME Program Requirements, Continued

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**Need to Know** During refueling, use the reactor cavity FME plan for all activities in the reactor cavity FME area per an attachment in the FME procedure.

**Specific Procedural Guidance** Use the Spent Fuel pool FME plan for all activities in the Spent Fuel Pool FME area per an attachment in the FME procedure.

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**FME Supervisor Duties** Prior to breaching (opening) the equipment, the FME supervisor shall ensure:

1. Areas above and around the breach are clean.
2. The FME area boundary is established and posted
3. A qualified FME monitor is assigned.
4. A material accountability log is established.

**High Risk FME Controls**

Maintaining the Standard FME Area

**Standard Risk FME Controls**

1. Conduct Pre-job briefs for workers discussing FME controls.
  2. Ensure workers review the FME procedure for items and activities requiring special controls, near or above the FME boundary.
  3. Ensure FME barriers are installed over equipment openings when required.
  4. Workers shall immediately report any dropped, lost, or otherwise unaccounted for material to the FME supervisor.
  5. If FME integrity is lost, as reported by employees, implement loss of FME integrity actions per the FME procedure.
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**FME Supervisor Duties**

1. FME supervisors may change the FME level or revise the FME controls (unless controlled by another procedure.)
2. If the FME plan or controls are described in the (work) order, the order will need to be revised.

**Modifying Controls or Plans**

- Following installation of FME barriers in equipment openings, a high risk FME area may be downgraded to a standard FME area.
3. If a high risk FME area is downgraded to a standard FME area because of installing FME barriers, the high risk FME area controls shall be reestablished prior to removing the FME barriers from the openings.
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## FME Program Requirements, Continued

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### FME Supervisor Duties

If FME barriers are installed and the area meets the requirements of a standard FME area, the FME supervisor may downgrade the FME area and implement a standard FME plan.

### Downgrading or Upgrading an FME Plan

- Except for accountability of the FME barriers, maintaining material accountability logs is not required.
- An FME monitor is not required.

Prior to removing the FME barriers, the FME supervisor shall upgrade the FME area and implement a high risk FME plan.

- An FME monitor shall be in place.
  - Material accountability shall be implemented.
- 

### Need to Know

You need to follow FME standards/requirements during the work activities on an open system or component by performing the following:

### FME Workers Responsibilities

- installing temporary covers when work is not in progress
- using fail-safe tools if required
- installing pipe dams if required and/or practical
- cleaning the internals of the system/component
- maintaining the FME Area to the required housekeeping condition
- complying with material control as required
- complying with personnel control as required
- complying with the information provided by the FME monitor
- stopping work and notifying supervision if FME control is lost
- reestablishing the FME Area, if required
- accounting for all materials prior to system or component closure
- checking all tools for missing parts or damage that may have been introduced into the plant system
- using approved solvents and chemicals
- using correct tools and materials

### Practice/Feedback

If the work being performed on a job cannot degrade the equipment, the following FME requirements are needed:

- A. **None, only good housekeeping practices**
- B. Standard FME Area
- C. High Risk FME Area

If Foreign Material cannot be identified by inspection or is not easily retrievable, the following FME requirements are needed:

- A. None, only good housekeeping practices
  - B. Standard FME Area
  - C. **High Risk FME Area**
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*End of Objective 5*

## FME Covers and Posting

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**Objective 6** Describe the guidelines for FME area covering and posting.

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### Need to Know

#### FME Boundaries

### Boundaries

1. The FME area boundary and the equipment breach (opening) may be the same. In other words, the opening in the pipe might also be the boundary of the FME Area and no other boundaries are erected. In this situation marking and posting the FME area boundary is not required. However, if the FME area boundary is marked, it shall be posted as described below.
2. **IF** the FME area boundary and equipment breach **are not the same**, then the FME area boundary:
  - **Shall** be clearly marked.
  - **Shall** be posted with warning signs. Use **FME AREA** sign provided in the procedure, or equivalent. (See example below.)



- Shall be as close to the equipment breach as possible.
- Should provide a controlled access point for personnel entry into the FME area.

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## FME Covers and Posting, Continued

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**FME  
Boundaries,  
continued**

Below is an example of a FME Area with warning sign posted



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## FME Covers and Posting, Continued

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### Need to Know

#### FME Barriers

### Barriers

A **FME Boundary is a roped off area**; a **FME barrier** is talking about what is done to actually **close off the breach (opening) in the piping system**. (Note: FME areas are not limited to just piping systems.)

1. An FME barrier shall be installed over the equipment breach whenever the breach is unattended or is not required to be open.
2. FME barriers placed over equipment breaches **shall** be posted with warning signs. Use the FME Cover sign, provided in the procedure, or equivalent. (See example below.)



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## FME Covers and Posting, Continued

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### FME Barriers, continued

Below is an example of a posted FME Cover Sign on an opened breach in system.



### Need to Know FME Barrier, continued

3. To prevent introducing foreign material into equipment, internal FME barriers should be used whenever possible to isolate equipment internal openings. (For example “Pipe Dams”.)
4. Internal FME barriers that can fit through the equipment breach shall be tethered externally to the equipment and logged on the Material Accountability Log.
5. Prior to removing any FME barrier, the person removing the barrier **shall**:
  - Obtain approval from the FME Supervisor
  - Inspect the area around the barrier and clean if needed.
  - If necessary, check system pressure behind the barrier.

**NOTE:** Isolation valve leakage may cause pressure build-up behind FME barriers.

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## FME Covers and Posting, Continued

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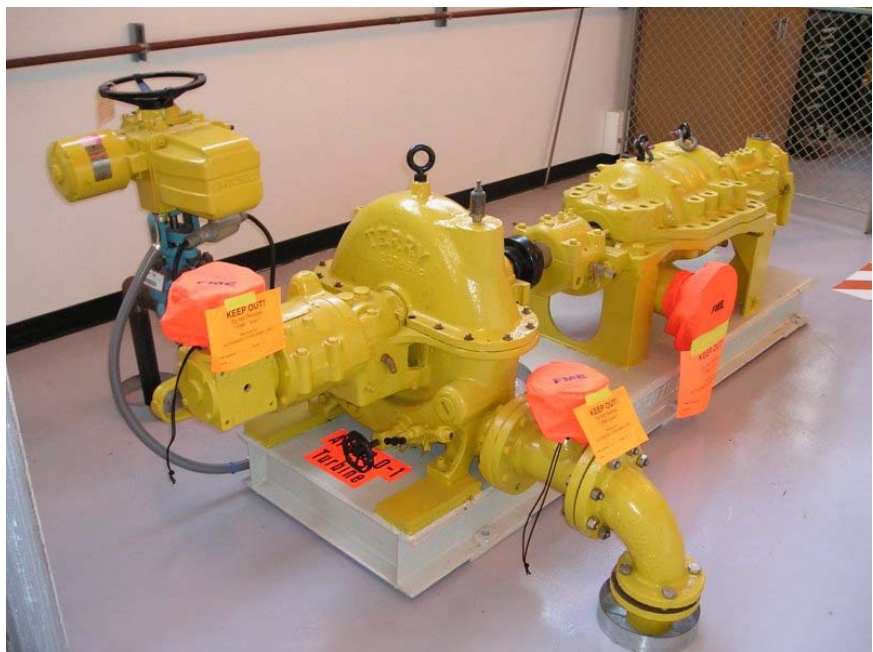
### Need to Know

### FME Barriers, continued

5. Paper pipe dams used for gas purges **SHALL NOT** be used as FME barriers.
6. FME barriers **shall**:
  - Not introduce foreign material into plant equipment during installation or removal.
  - Prevent dropped material from entering plant equipment.
  - Allow inspection of the barrier for trapped debris prior to removal.
  - Either allow removal of trapped debris from the barrier or allow removal of the barrier without loss of any trapped debris.
  - Resist tearing, splitting or melting.
  - Be fire retardant or fire resistant.
  - Be chemically and physically compatible with the equipment.
  - If required, allow airflow to provide confined space ventilation or provide a system vent path.

Examples of Barriers below:

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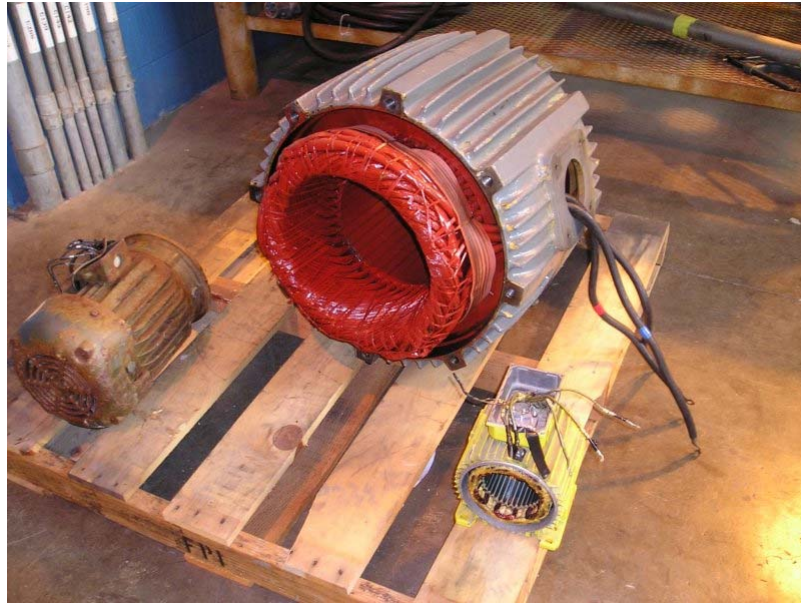


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# FME Covers and Posting, Continued

Examples of Inadequate and Adequate FME Barriers

No FME Barriers in place to prevent foreign material intrusion



Adequate FME Barrier to prevent foreign material intrusion



Continued on next page

## FME Covers and Posting, Continued

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**Practice /  
Feedback**

When an FME barrier is constructed it should meet the following requirements, **EXCEPT...**

- A. Not introduce foreign material into plant equipment during installation or removal.
- B. Resist tearing, splitting or melting.
- C. Water / air tight to prevent liquids from escaping.**
- D. Be fire retardant or fire resistant.

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*End of Objective 6*

## Loss of Integrity Actions

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### Objective 7 Discuss requirements for loss of integrity actions.

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#### Need to Know

#### Loss of FME integrity

A loss of FME integrity occurs when:

- Foreign material is found inside equipment upon initial opening.
- Material that is logged into a High Risk FME area cannot be accounted for during log reviews or closure activities.
- Non-failsafe material is found inside a High Risk FME area that is not logged into the area.
- Non-failsafe items become detached from lanyards inside the FME area.
- Material that is dropped into equipment cannot be immediately retrieved.
- Material that cannot float is dropped into or found in the reactor cavity or spent fuel pool.
- FME barrier integrity is lost.
  - For example:
    - Pipe dams are deflated or damaged
    - Covers are found damaged or missing when the area has been left unattended.

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## Loss of Integrity Actions, Continued

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**Nice to Know****Recovery from loss of Integrity, continued**

Recovery actions will only take place after you have notified the FME Supervisor of a problem and plan is developed to recover.

- There are many methods available for locating material, refer to the procedure for specific methods.
  - If the foreign material cannot be retrieved, engineering assistance should be obtained to determine alternate retrieval methods or to determine the effects of the foreign material on the system.
- 

**Practice / Feedback**

The following are indications of a loss of FME Integrity, **EXCEPT** for...

- A. Foreign material is found inside equipment upon initial opening.
  - B. Non-failsafe material is found inside a High Risk FME area that is not logged into the area.
  - C. Non-failsafe items become detached from lanyards inside the FME area.
  - D. **A yellow plastic bag that does float is dropped into spent fuel pool.**
- 

*End of Objective 7*

## Material Accountability

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**Objective 8**

**DESCRIBE the "Material Accountability Controls" requirements that apply to all High Risk FME areas.**

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**Logging  
Material**

The FME worker and/or FME monitor shall inspect all items entering and leaving the FME area.

- Fail-safe items do not require logging, unless specified otherwise.
- Nonfail-safe items, including dosimetry and personal items shall be logged into and/or out of the FME area.
- Any items exempt from logging should be listed in the specific FME plan.

Internal (such as a pipe plug) FME barriers shall be logged, **except:**

- When installation and removal of the FME barrier is controlled by a procedure.
- The procedure provides signoffs for documenting installation and removal of the FME barrier.

Items with missing parts or fasteners shall be logged, and the location of the missing part or fastener noted in remarks or marked or indicated on the item.

Disposable items may be brought into an FME area without logging

- The FME supervisor may authorize relief from requirements to log certain disposable items entering the FME area.
- Disposable items shall be:
  - Brought into the FME area in a container that is fail-safe
  - Used at one job-site only
  - Controlled by workers at the job-site
  - Disposed of in a fail-safe container at the job-site

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## Material Accountability Controls, continued

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**NOTE:**

The Personnel Entry Log (PEL) should be completed by the individual FME worker and the Material Accountability Log (MAL) should be completed by the FME Monitor

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**Logging  
Instructions**

Print all information completely and accurately.

- Record time in 24 hour format. For example: 0630, 1425, 0050, and 2310.
- Record the FME worker or monitor's user ID or keycard number on each FME area entry and exit.
- Amplifying information associated with the entry may be entered in the Remarks section and cross-referenced to a reference number in the *Remarks* column.
- The MAL may be used to log all items entering the FME area when a qualified FME monitor is provided. To help find an item in the FME area, enter its location on the PEL or MAL.
- If an item is moved to a new location inside the FME area, a new entry using the revised location information should be made on the PEL or MAL.
- Upon final exit from the FME area, account for all items logged into the area.
- If a Personnel Entry Log is being closed out and an item is to remain in the FME area then the item must be transferred to the Material Accountability Log by a qualified FME monitor.

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## Material Accountability Controls, continued

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### Personnel Entry Log (PEL)

The PEL may be used for entries into high risk FME areas, including the Reactor Cavity and the Spent Fuel Pool FME areas.

The PEL is valid for one shift and may be used for several entries into the FME area. If the FME area will last less than one shift then a MAL is not required to be used.

Upon final exit from the FME area the PEL should be placed in an INACTIVE file.

Until final area closeout, inactive PELs:

- May be retained at the FME area or at another location, as desired by the FME supervisor.
- Shall be available for accuracy and reconciliation reviews.

Following FME area closeout, PELs shall be forwarded to the responsible group or individual for retention.

---

### Practice

If an FME is in place for less than one shift do you need to use a Material Accountability Log?

- A. Yes
- B. No**

The Personnel Entry Log can be filled out & maintained only by a qualified FME Monitor.

- A. True
- B. False**

When entering the time on a log, how would 2:15 PM be written?

- A. 2:15 PM
  - B. 0215
  - C. 1415**
- 

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# Material Accountability, Continued

**PRINT — USE INK**  
Enter time in 24 hour format

**\*\* THIS PEL IS VALID FOR ONE SHIFT \*\***

**COMPLETE THE FOLLOWING:** UNIT No.: \_\_\_\_\_ DATE: \_\_\_\_\_

Name: \_\_\_\_\_ Dept / Team: \_\_\_\_\_

Phone: \_\_\_\_\_ Keycard: \_\_\_\_\_ Order or RWP: \_\_\_\_\_

Supervisor: \_\_\_\_\_

Work Area: Rx Head  — Rx Cavity - Edge  Lower  Upper  — Stm Gen 1  2  3  4   
(check one)

SFP  — Other  (describe) \_\_\_\_\_

**ENTRY Checklist**

1. Log in nonfail-safe dosimetry or personal items for **each** entry.
2. Log in nonfail-safe items for **each** entry.
3. Inspect all items entering the FME area.
  - No visible foreign material.
  - No loose or missing parts or fasteners.
4. Lanyard items that could fall into equipment.
5. Empty outer pockets or seal shut.
6. Minimize consumables taken into the FME area.

**PROHIBITED ITEMS**

- DO NOT** take into any high risk FME area:
- Easily breakable items.
  - Staples or paperclips.
  - Safety glasses that might fall apart. Such as Wilson Spectra II.
- DO NOT** take into Rx or SFP FME area:
- Ty-wraps with metal clips
  - Clear plastic sheeting, sleeving, wrappers or bags. Marked twirl packs are exempt.

**Fill in all spaces**

**Enter: Y-Yes, N-None or number if more than one**

ENTRY		DOSIMETRY			PERSONAL ITEMS			EXIT	
Time	Monitor <sup>1</sup>	TLD	PED	PIC	Glasses	Badge	Pager	Time	Monitor <sup>1</sup>

<sup>1</sup>**Monitor** — Use PIMS ID or keycard number

**EXIT Checklist:**

1. Log out nonfail-safe dosimetry or personal items upon **each** exit.
2. Log out or transfer nonfail-safe items upon **final** exit.
3. Inspect all items removed from the FME area.
  - No undocumented missing parts or fasteners.
4. Remove all consumable material upon **final** exit.
5. Report unretrievable or lost items to the FME supervisor.
6. Ensure all fail-safe items are removed.

Material description, quantity, and location in the FME area <small>(Detail individual items/assemblies) (Use additional lines as necessary)</small>	Remarks <small>Remarks Number</small>	Entry		Exit		Disposition	
		Time	Monitor <sup>1</sup>	Time	Monitor <sup>1</sup>	Code <sup>3</sup>	MAL & Page# <sup>2</sup>
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							

**Remarks:**

<sup>1</sup> **Monitor** — Use PIMS ID or keycard number

<sup>2</sup> **MAL & Page #** — Examples: C-3 or D-4

<sup>3</sup> **Disposition Codes:**

- R – **Removed** from the area.
- I – **Installed** and will remain in the area.
- E – **Exchanged** for a like item in the area.
- M – **Moved** to a new location inside the area.
- L – Found or dropped in the area and **left** in the area.
- V – **Verified** in the FME area during closeout.
- T – **Transferred** to the MAL.

Reviewed By: \_\_\_\_\_

Date: \_\_\_\_\_

**End of Objective 8**

## Special Controls

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**Objective 9** Identify items and activities that require special controls in or near High Risk FME areas.

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**Need to Know Restricted Items** The following items are not permitted in a high risk FME area, including the Reactor Cavity and Spent Fuel Pool FME Areas.

1	Wire brushes and wire wheels.
2	Metal staples and paper clips.
3	Items with visible foreign material.
4	Items with loose parts or fasteners.
5	Easily breakable items, <i>except glass light bulbs are exempt.</i>
6	Safety glasses that can fall apart (lens may pop out, etc.). Such as Wilson Spectra II

---

**Need to Know Restricted Items** In addition to the first list the following items **shall not** be allowed into the Reactor Cavity and Spent Fuel Pool FME Areas.

1	Ty-wraps with metal clips. For acceptable metal free ty-wraps, see the approved consumable materials list.
2	Wire brushes and wire wheels.
3	Clear plastic sheeting, sleeving, bags, or clear plastic hose. The following clear plastic items are exempt: <ul style="list-style-type: none"> <li>• Clear plastic face on a bubble suit</li> <li>• Bags having colored stripes (twirl packs)</li> </ul>

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**Need to Know Special Controls** Prior to starting work above or adjacent to an FME area or FME boundary, You must:

- Inform the FME Supervisor/Monitor of any activities that may release material in an uncontrolled manner.
- The FME Supervisor **shall** evaluate the acceptability of any special controls required to contain the material or prevent its entry into plant equipment.

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## Special Controls, Continued

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### Special Controls, continued

The following are examples of activities that may require special controls to prevent introduction of foreign material into an FME area.

- Working above or adjacent to the FME boundary. (Example: Steam Generator catwalk around Reactor Cavity)
  - Working over the FME area, such as on a crane. (Example: over or near the Spent Fuel Pool or Reactor Cavity)
  - Using wire wheels or brushes
  - Welding or burning that produces hot slag
  - Using grinding wheels
- 

### Need to Know Cranes

Prior to moving a crane over or into a high risk FME area. The crane **shall** be inspected for foreign material.

1. The crane **shall** be free of debris, excess lubricant, and loose fasteners or components.
    - a) All **no-fail safe** foreign materials **shall** be removed from the crane or logged in the material accountability log.
    - b) The inspection can be performed by the FME Supervisor, crane operator, or other individual familiar with the FME requirements for the area.
    - c) Documentation of inspection results **is not** required.
    - d) The FME Supervisor **shall** authorize moving the crane into the FME area.
  2. If access to the crane and introduction of foreign material onto the crane are controlled following the initial crane inspection, additional crane inspections and entry authorizations are not required when moving the crane over or into a high risk FME area.
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## Special Controls, Continued

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**Practice /  
Feedback**

Are the following statements true or false?

Cranes can be moved over a high risk FME if the crane is inspected for foreign material first.

- A. True
- B. False

Only the FME Supervisor can perform the inspection of a crane prior to moving it over a high risk FME area.

- A. True
- B. False

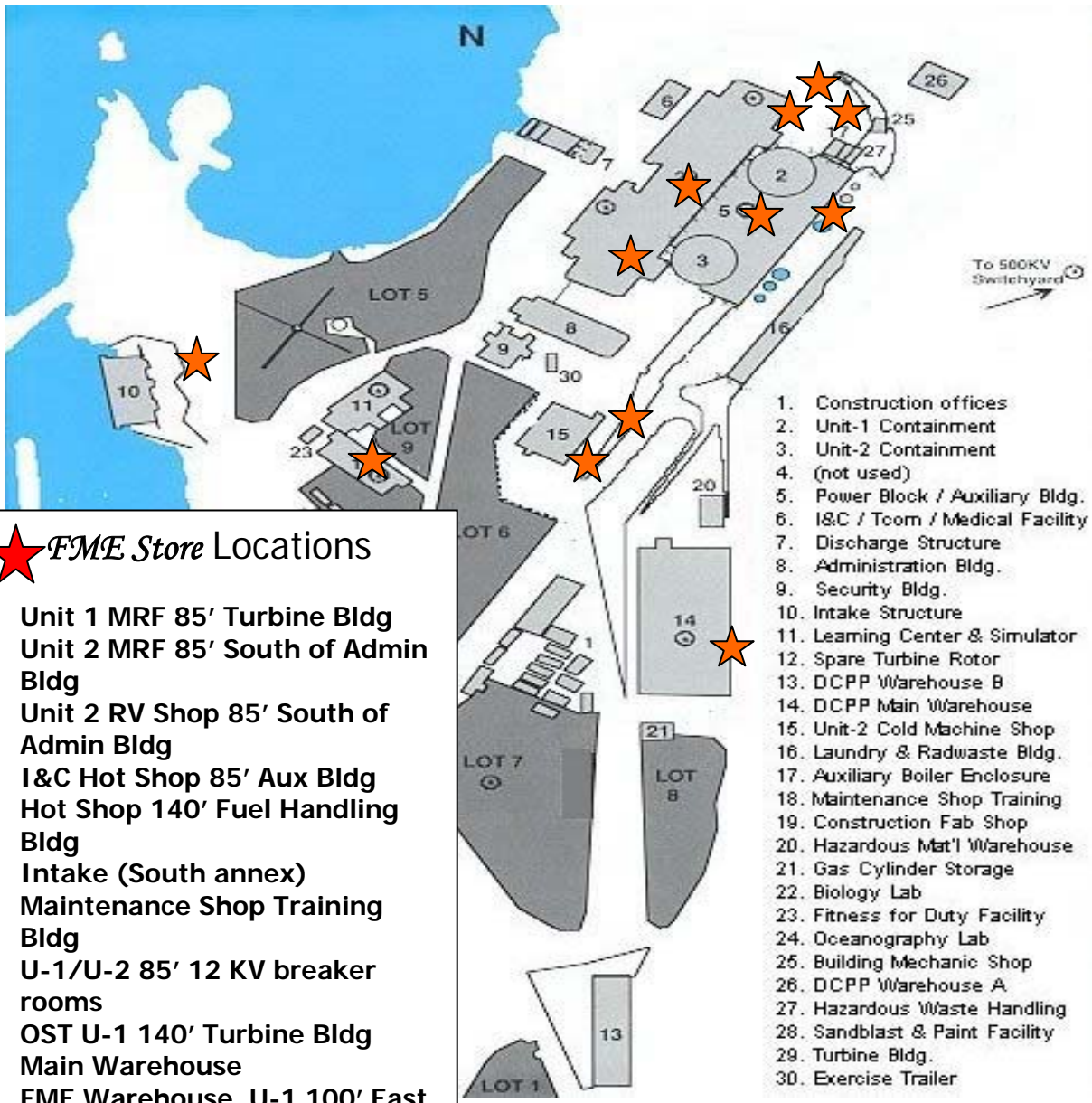
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*End of Objective 9*

# CURRENT ISSUES

**Introduction** The following information regarding the Foreign Material Exclusion Area program is new or important issues that effect the way we as workers prevent Foreign Material intrusion into plant equipment or components.

- FME Store**
- FME Store cabinets are located in various areas of the plant as shown below.
  - The FME Store has the most popular items that you may need to meet the needs of the DCPD FME program.



- ★ FME Store Locations**
- Unit 1 MRF 85' Turbine Bldg
  - Unit 2 MRF 85' South of Admin Bldg
  - Unit 2 RV Shop 85' South of Admin Bldg
  - I&C Hot Shop 85' Aux Bldg
  - Hot Shop 140' Fuel Handling Bldg
  - Intake (South annex)
  - Maintenance Shop Training Bldg
  - U-1/U-2 85' 12 KV breaker rooms
  - OST U-1 140' Turbine Bldg
  - Main Warehouse
  - FME Warehouse, U-1 100' East Buttress

Continued on next page

## CURRENT ISSUES, Continued

**FME Stores  
will look like  
this**

- Located in the cabinets are FME cover and barrier signs, and FME cover bags from 4" to 24".
- There are (will be) pipe caps and plugs for 1/4" up to 2" pipe.
- Tubing caps and plugs are also available.
- The most common tubing size is 3/8".
- Blind flange covers in various sizes and materials are also available.
- Don't see what you need? Call or page x4071 for additional information.

***Visit the FME Store today***



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## CURRENT ISSUES, Continued

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**DCPP Event****Adverse trend in FME events during 2R13 Refueling outage.**

An adverse trend in FME events during the 2R13 refueling outage (May of 2006) led to initiation of this Non Conformance Report (NCR). The analysis showed at DCPD over the last several years that the focus was aimed towards *correcting* FME problems instead of *preventing* problems.

Identified problems were:

Equipment damage from foreign material was identified as:

- Dented fuel bundle grid strap in Unit 2
- Minor deformation on a Unit 2 fuel bundle flow nozzle
- Inhibited movement of a Unit 2 reactor coolant pump over current relay
- A fret mark on a Unit 1 fuel rod (1R13), and other historical equipment damage.

The corrective actions to prevent recurrence and improve performance include:

- Strengthen line ownership of the FME program to foster stewardship of FME fundamentals.
- Revise the FME program procedure to enhance management expectation communication.
- Implement a separate level of FME worker training to improve understanding of FME requirements. (*The reason for this lesson.*)

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## CURRENT ISSUES, Continued

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**Industry  
FME Event****Failed Dead Blow Hammer and Loss of FME Integrity (Wolf Creek)**

Misapplication of dead blow hammers containing BB type shot can cause foreign material exclusion (FME) events.

Short description of event:

- An electrician used a dead blow hammer on a knocker wrench to tighten a jam nut on a bolt used to apply a torque wrench to a reactor coolant pump motor rotor.
- The dead blow hammer split/shattered causing a loss of foreign material exclusion (FME) integrity.
- The electrician did not select the best tool for the job and was unaware dead blow hammers were filled with BB type shot that could potentially be an FME concern.

**Lessons Learned:**

Ensure that when selecting a tool to perform work inside or near FME areas that you inspect it for any visible damage or missing/loose components and determine that no unforeseen events will occur because of its use.

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*End of Current Issues*

## Summary

### Review of the Lesson

#### Terminal Objective

Upon completion of this lesson, the student will serve as a FME worker and take appropriate preventive measures to preclude the potential for inadvertent introduction of foreign material into plant systems or components in accordance with AD4.ID6, Foreign Material Exclusion Program.

#### Enabling Objectives

Number	Enabling Objective Description
1	State the objective and goal of the Foreign Material Exclusion Program.
2	Define terms associated with FME.
3	Identify the FME Worker and other FME personnel responsibilities.
4	Discuss the DCPD Site Standards Handbook expectations for FME.
5	Describe the implementation requirements for an FME plan.
6	Describe the guidelines for FME area covering and posting.
7	Discuss requirements for loss of integrity actions.
8	Describe the "Material Accountability Control" requirements that apply to all High Risk FME areas.
9	Identify items and activities that require special controls in or near High Risk FME areas.

#### Summary

Once again the plant procedure for FME controls that we have been referring to throughout this lesson is AD4.ID6. Following procedural requirements is necessary to keep foreign material out of plant systems and components.

#### Learning Assessment

Assessment of the student's comprehension will be evaluated by written exam.

*End of Lesson Guide*