

## Attachment 2

### Degradation Rating Guidance Specific to Various Fire Protection Program Elements

This appendix provides guidance on the assignment of a degradation rating to various findings. Degradation rating guidance is provided for each of the finding categories defined in Step 1.1.

#### **FIRE PREVENTION AND ADMINISTRATIVE CONTROLS PROGRAMS**

This section provides guidance on assignment of a degradation rating to findings against the plant fire prevention program and other administrative controls (e.g., hot work permitting, transient combustible control programs, fire watches, etc.).

#### **Findings against hot work permitting or fire watch provisions:**

Degradations for fire watches for hot work can be low and high. The following provides a general description of the applied degradation levels:

- **Low** degradations are warranted for inspection violations that will not have any significant effect on the likelihood that a fire might occur, or that a fire which does occur might not be promptly suppressed. Examples of low degradations are as follows:
  - Fire watch not having specific familiarity with the facility at the location of the hot work, the hazards of the work and procedures for sounding an alarm at that point as determined from an interview after completion of a watch
  - Improper fire watch training consisting of records showing a lack of required basic courses, refresher courses, and practice drills
  - Cases where a portable extinguisher of the proper type is nearby (within 30 feet - unobstructed distance) even though watchers are inadequately equipped with fire extinguishers or other required equipment. This includes cases where a the proper portable extinguisher is nearby even though:
    - Not having a portable fire extinguisher on the watch when one is required by the hot work permit
    - Having a discharged or inadequately charged extinguisher
    - Having the wrong type of extinguisher for the fire hazards involved or conditions at the site (dry chemical in an area of high wind currents)
  - Violations of the hot work permitting program, but all normally required fire prevention measures (e.g., a properly equipped and trained fire watch) are in place.
  - Violations associated with hot work record keeping.
- **High** degradation implies that early suppression (by the fire watch) is not available. Examples of high degradations are as follows:
  - Failures to implement a continuous fire watch in positions to observe all areas of vulnerability to a fire from the hot work operation
  - Failure to implement a fire watch at the site
  - Fire watch that is inadequately equipped with fire extinguishers or other required equipment. Inadequately equipped includes:
    - Not having a portable fire extinguisher on the watch when one is required by the hot work permit
    - Having a discharged or inadequately charged extinguisher

- ▶ Having the wrong type of extinguisher for the fire hazards involved or conditions at the site (dry chemical in an area of high wind currents)
- • Fire watch failing to maintain any one of the following safe conditions<sup>1</sup> during hot work operations:
  - ▶ Location is free of combustibles or that combustibles that can not be moved are shielded against ignition
  - ▶ Hot work equipment to be used shall be in satisfactory operating condition and in good repair
  - ▶ Where combustible materials, such as paper clippings, wood shavings, or textile fibers are on the floor, the floor shall be swept clean for a radius of 35 ft
  - ▶ Combustible floors wet down, covered with damp sand or fire-resistant sheets for a 35 ft. radius
- • Fire watch failing to maintain fire watch for at least ½ hour after completion of hot work at all required observation points

Note that fire watches compensating for temporary loss of detection/suppression and/or barriers primarily impact early fire detection/suppression time for ignition sources other than hot work and are treated in their respective places in this document.

**Findings against the combustible controls program:**

Another finding which potentially can affect frequency is violation of transient combustible control limits, specifically those combustibles which could result in the ignition of a fire from existing sources of heat or electrical energy. Transient combustibles of significance from a fire frequency standpoint are considered to be low flashpoint liquids (below 200 °F) and self igniting combustibles (oily rags). In addition to combustibles, evidence of tobacco smoking or the existence of unauthorized heaters or heat sources can also be considered as adversely affecting compartment fire frequency.

Degradations ratings for findings against the combustible controls program are either low or high (no moderate level is defined). Examples of low and high degradations are as follows:

- **Low** degradation:
  - • Low flashpoint combustible liquids in quantities above those allowed by plant regulations but in approved containers
- **High** degradation:
  - • A measurable quantity of a low flashpoint (200°F) combustible liquid beyond the quantity allowed by the plant’s combustible loading controls, unattended, and not in an approved container.
  - • Unattended storage of self heating materials such as oily rags not in an approved container
  - • Evidence of smoking in a non-smoking area
  - • An unapproved heater or heat source in the area

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<sup>1</sup> Safe conditions were obtained from list of conditions in subsection 3-3.2 in NFPA 51B, “Standard for Fire Prevention During Welding, Cutting, and Other Hot Work,” 1999.

## FIXED FIRE DETECTION & SUPPRESSION DEGRADATION

### Fire Detection:

- **Low** degradation:
  - If an area has a degraded detection system, but there is a redundant undegraded detection system in the area
  - Less than 10% of smoke or heat detectors are degraded (nonfunctional, misplaced or missing), and functional detection is available near combustibles of concern. (Not applicable for areas with the potential for unconfined combustible or flammable liquid fire)
  - Less than 25% detectors (heat or smoke) degraded (nonfunctional, misplaced or missing) in continuously occupied areas
- **Moderate** degradation: A degradation level between Low and High.
- **High** degradation: System will fail to function
  - Power off
  - Detectors incompatible with system
  - Annunciators disabled, inaudible, or nonfunctional

### Water Based Suppression:

- **Low** degradation:
  - Less than 10% of heads are non functional **and**  
There is an functional head is within 10 feet of combustibles of concern, **and**  
System is nominally code compliant.
- **Moderate** degradation:
  - Less than 25% of the heads are non functional **or**
  - The closest functional head is between 10 and 20 feet of combustibles of concern.
- **High** degradation:
  - Non functional system, **or**
  - 25% or more of heads out of service, **or**
  - Nearest head greater than 20 feet from combustibles of concern.

### Gaseous Based Suppression:

Note: Depending on the type of degradation, for example, a hole that goes to the control room, a low degradation, may be problematic. Meaning, the system may be effective at extinguishing but the system may cause control room evacuation or the donning of SCBAs by the control room operators.

- **Low** degradation:
  - Hole in wall or floor less than area of one five inch diameter penetration seal (Not to control room or remote shutdown area)
  - Hole in ceiling up to 100 square inches (Not to control room or remote shutdown area)
  - Time delay in system operation of exceeds design by 60 seconds or less
  - Discharge heads are obstructed

- Discharge time exceeds allowable by less than 25%
  - Lack of test data
  - Test data shows concentration for 15 minutes (where 20 minutes are required for licensing basis)
  - Achievable concentration is Halon 6% (where 7% is committed), or CO<sub>2</sub> 50% (where 60% is committed)
- **Moderate** degradation:
    - Design concentration achieved but cannot be maintained for sufficient time to ensure fire extinguishment
  - **High** degradation: System will fail to function
    - Power off
    - Inadequate agent to achieve required concentration for deep seated fires: Halon less than 5%; CO<sub>2</sub> less than 40%.

**FIRE BARRIER DEGRADATION - Fire Confinement and Localized Cable or Component Protection**

The approach to assigning a degradation rating to fire confinement and localized cable or component protection findings (see Step 1.1) is similar. The analysis approach for quantifying these two finding categories is also similar. These two categories cover findings of degradation to any passive fire barrier feature.

For fire barriers, four levels of degradation have been defined. In particular, the moderate degradation level has been split into two sub-levels; namely, 'Moderate A' and 'Moderate B'. Moderate B will reflect a more severe level of degradation than Moderate A, although consistent with the generic definition of a moderate degradation, both rankings will imply that some substantial credit will be given despite the observed degradation. This distinction allows for additional discrimination in assessing performance degradations against a fire barrier or barrier element.

<b>Table A2.1 - Degradation Levels for Application to Fire Barriers and Barrier Elements</b>	
<b>Low</b>	Minor defect observed that will have no effect on fire endurance, no performance reduction applied
<b>Moderate A</b>	Fire barrier performance is reduced to approximately 65% of nominal fire endurance rating
<b>Moderate B</b>	Fire barrier performance is reduced to approximately 35% of nominal fire endurance rating
<b>High</b>	No Fire barrier or fire barrier/penetration integrity is severely challenged - No credit for barrier

The guidance for assigning one of the above degradation levels depends on the type of fire barrier being considered. The table on the following pages provides examples to illustrate how an observed degradation is correlated to a degradation rating for each of several fire barrier types. The inspector should select the fire barrier type that most closely matches the barrier being considered and continue the evaluation.

**Table A2.2 - Guidance for Ranking an Observed Fire Barrier Degradation Finding Based on the Type of Barrier System Against Which the Degradation Has Been Noted**

Characteristics Associated with Each Degradation Level				
Barrier Type	Low	Moderate A	Moderate B	High
Elastomers: low density/ high density (e.g., silicone foam)	<ul style="list-style-type: none"> <li>Less than 10% of req'd seal depth missing</li> <li>Barriers/components not in preventative maintenance program</li> <li>Seal materials not listed in program</li> <li>Greater than 12 inches of material</li> <li>Poor quality foam cell structure (falls within Dow Corning's #6 category) over &lt;25% of the surface area</li> <li>Through cracks smaller than 1/8" in seal material that are less than 50% of the seal depth</li> <li>1/8" thru barrier gaps or cracks</li> </ul>	<ul style="list-style-type: none"> <li>10 to 25% of seal req'd depth is missing</li> <li>Poor quality foam cell structure (falls within Dow Corning's #6 category) of approximately &gt;25% of the surface area</li> <li>No tested or evaluated configuration between 9 and 11 inches depth</li> </ul>	<ul style="list-style-type: none"> <li>Greater than 3/8" cracks in seal material extend to opposite face</li> <li>No tested or evaluated configuration between 6 and 9 inches</li> </ul>	<ul style="list-style-type: none"> <li>No tested or evaluated seal configuration and less than 6 inches of foam</li> <li>&gt; 50% required barrier depth removed or never installed</li> <li>Through crack or equivalent diameter greater 1"</li> </ul>
Sacrificial and non-sacrificial board or blanket (e.g., mineral wool or ceramic fiber)	<ul style="list-style-type: none"> <li>&lt; 10% depth of barrier material removed or never installed</li> <li>Through crack or equivalent diameter of 1/2" or less</li> <li>Compression of material</li> </ul>	<ul style="list-style-type: none"> <li>10% to 25% design depth of barrier material removed or never installed over 6 in area</li> <li>Through crack or equivalent diameter of greater 1/2" up to 1"</li> <li>Large metallic cross section support or large cross section cables entering wrap without 2-6" of wrap</li> </ul>	<ul style="list-style-type: none"> <li>25% to 50% design barrier material depth over area of 6 sq. in. Material removed or never installed</li> <li>Through crack or equivalent diameter of greater than 1" up to 2"</li> <li>Large metallic cross section support or large cross section cables entering wrap with less than 2" of wrap</li> </ul>	<ul style="list-style-type: none"> <li>No tested or evaluated barrier configuration</li> <li>&gt; 50% required barrier depth removed or never installed</li> <li>Through crack or equivalent diameter greater 2"</li> </ul>

**Table A2.2 - Guidance for Ranking an Observed Fire Barrier Degradation Finding Based on the Type of Barrier System Against Which the Degradation Has Been Noted**

Characteristics Associated with Each Degradation Level			
Barrier Type	Moderate A	Moderate B	High
Unique / Boot seals	<ul style="list-style-type: none"> <li>Support missing</li> </ul>	<ul style="list-style-type: none"> <li>2-3" of seal</li> </ul>	<ul style="list-style-type: none"> <li>No ceramic fiber</li> </ul>
Concrete and cement-based grout or penetration seal materials	<ul style="list-style-type: none"> <li>Greater than 30% of required concrete depth missing</li> </ul>	<ul style="list-style-type: none"> <li>Large surface area deformations (over 50% of surface) which would cause higher heat absorptions</li> <li>&lt;4.5 inches thick</li> </ul>	<ul style="list-style-type: none"> <li>Cracks determined to interfere with structural integrity</li> <li>&lt;2 inches thick</li> </ul>
Doors	<ul style="list-style-type: none"> <li>Small screw holes in doors &lt;3/8" on both sides</li> <li>Improperly installed fire door hardware (other than latch)</li> <li>Bent or warped fire door with gaps less than 1 inch</li> <li>Fire door to frame or floor clearance gaps up to 1 inch</li> </ul>	<ul style="list-style-type: none"> <li>Multiple holes in door surface with greater than 1 inch opening</li> <li>Door latch not functional</li> <li>Latch engagement &lt;1/2 inch</li> </ul>	<ul style="list-style-type: none"> <li>Door propped open or broken latch</li> </ul>
	<ul style="list-style-type: none"> <li>Severe tears, loose bands, open bands, outer boot missing</li> <li>Missing boot both sides</li> <li>Surface cracks &lt; 1/16" with no noticeable depth penetration</li> <li>Through cracks smaller than 1/8" in barrier that are not more than 50% of the required barrier thickness</li> <li>1/16" thru barrier gaps or cracks</li> </ul>		
	<ul style="list-style-type: none"> <li>Improper non-combustible door labeling material</li> <li>Several small open exposed holes in doors, door gap issues not exceeding 25% of manufacturer's recommended specifications or up to 3/8" gap</li> <li>Multiple holes in door on one side of a door surface with less than 1/8" inch opening</li> <li>Door frames with greater than 1/8" thru gap</li> </ul>		

**Table A2.2 - Guidance for Ranking an Observed Fire Barrier Degradation Finding Based on the Type of Barrier System Against Which the Degradation Has Been Noted**

		Characteristics Associated with Each Degradation Level			
		Low	Moderate A	Moderate B	High
Dampers		<ul style="list-style-type: none"> <li>Damper not in maintenance inspection program</li> <li>Damper frames with greater than 3/8" thru gap</li> <li>Damper can close completely</li> </ul>	<ul style="list-style-type: none"> <li>Damper will close greater than 95%, Temperature of fusible link excessively high or fusible link improperly installed</li> </ul>	<ul style="list-style-type: none"> <li>Damper will close &gt;90%</li> <li>No damper at fire barrier in steel duct work</li> <li>Damper is not rated to close against anticipated ventilation</li> </ul>	<ul style="list-style-type: none"> <li>Damper sealing less than or equal to 90%, will not close</li> <li>Broken latch (where latch required for closure)</li> <li>No damper installed</li> </ul>
Unsealed conduits		<ul style="list-style-type: none"> <li>Conduits smaller than 1 inch with 3 feet on each side of barrier</li> </ul>	<ul style="list-style-type: none"> <li>Conduits &gt; 4 Inch with greater than 5 feet on each side of barrier or &gt;2 Inch with greater than 3 feet on each side of barrier</li> </ul>	<ul style="list-style-type: none"> <li>Conduits &gt; 4 Inch with less than 5 feet on each side of barrier or &gt;2 Inch with less than 3 feet on each side of barrier</li> </ul>	

### **Water Curtain:**

- **Low** degradation - Less than 10% of heads obstructed or fouled, and no adjacent heads fouled.
- **Moderate** degradation - Not applicable.
- **High** degradation - Greater than 10% of heads obstructed or fouled or two adjacent heads fouled or obstructed. System nonfunctional.

### **Radiant Energy Shields:**

Note: If the radiant energy shield is a 'Rated' barrier (Darmatt, Interram), use the appropriate barrier type from elsewhere in this table.

- **Low** degradation:
  - Barrier completely obstructs line of sight between the target of interest and potential fire sources that could affect redundant targets, and it is non-combustible.
- **Moderate** degradation:
  - Barrier provides partial line of sight obstruction between target of interest and potential fire sources that could affect redundant targets, or
  - It is combustible, but of rated material (Thermo-Lag).
- **High** degradation:
  - Barrier does not provide line of sight obstruction between target of interest and potential fire sources that could affect redundant targets, or
  - It is combustible and not made of a rated material.

## **SAFE SHUTDOWN FINDINGS**

Safe shutdown findings are related to degradations in operational aspects of post fire safe shutdown such as manual actions, analysis of associated circuits, analysis of required circuits, spurious operation, alternate shutdown, fire response procedures, the post-fire safe shutdown analysis, etc.

The safe shutdown finding category is not intended to cover findings against physical protection of the designated safe shutdown path such as passive fire barriers, fire detection, and fire suppression. Findings against physical protection features are covered under other finding categories.

For findings related to the licensee's post-fire SSD program, three levels of degradation have been defined with examples as follows:



<b>Table A2.3 - Guidance for Ranking an Observed SSD Degradation Finding</b>	
<b>Quantification Rank</b>	<b>Examples</b>
<b>Low</b>	<ul style="list-style-type: none"> <li>• Typographical procedure errors, where the intent is clear or can be easily inferred from the procedures context</li> <li>• Minor procedural deficiencies that are compensated by operator experience/familiarity</li> </ul>
<b>Moderate</b>	<ul style="list-style-type: none"> <li>• Procedural inconsistencies between EOPs and Fire SSD procedures</li> <li>• Equipment or tools not staged or located as specified by procedures</li> <li>• Operator training on fire SSD procedures incomplete</li> <li>• Feasibility to perform specified manual actions with available staff is not apparent</li> </ul>
<b>High</b>	<ul style="list-style-type: none"> <li>• Post-fire SSD analysis is incomplete</li> <li>• Locations for actions required in SSD procedures are in environmentally challenging areas (e.g., low or high temperatures, high humidity)</li> <li>• Plant conditions cannot be assessed or readily inferred from information available to the operators or as addressed in Fire SSD or EOP procedures</li> <li>• Plant design or component design severely impacts operator performance of SSD operations</li> <li>• Lack of alternate shutdown procedure</li> </ul>

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