March 29, 2000

MEMORANDUM TO: Michael R. Johnson, Section Chief
Inspection Program Branch
Division of Inspection Program Management

FROM: August Spector ***/RA/***
Inspection Program Branch
Division of Inspection Program Management

SUBJECT: REVISED REACTOR OVERSIGHT PROCESS PUBLIC MEETING HELD ON FEBRUARY 15-16, 2000

The NRC conducted a Public meeting on the subject of Fire Protection issues related to the Revised Reactor Oversight Process on February 15 - 16, 2000, at One White Flint North, Rockville, Md. The meeting agenda, list of attendees and handouts are attached.

Attachments:
1. Agenda
2. Attendees
3. NEI Viewgraphs - Industry Recommendations for Fire Protection Inspection
4. NEI comments on 71111.05
5. NEI comments on Appendix 4
6. NEI comments 2.11.00
7. SDP scenarios 2.14.00

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Revised Reactor Oversight Process

Fire Protection Meeting Agenda

February 15 - 16, 2000

Day 1 - Fire Protection Significance Determination Process

Day 2 - Fire Protection - Inspection Procedures

List of Attendees on February 15, 2000

NAME	AFFILIATION
Jim Sumpter	NPPD
Sheldon L. Trubatch	Fire Protection Clearing House
Andy Robosky	SGEG’s
Greg Gibson	SoCal Ed
Cyrus Anderson	SoCal Edison/SONGS
Stephen Dinsmore	NRC/NRR/SPSB
Eric Jebsen	ComEd
David F. Wilson	Rochestery Gas & Electric
Johnny Eads	CP&L
Les Bailey	Southern Nuclear
David J. Conti	NAESCO
Fred Emerson	NEI
Rich Pinney	New Jersey DEP
Tom Cleary	Northeast Utilities
Steve Hardy	CP&L
Roger Sims	CP&L
Richard Bashall	Proto-Power Corp
Brian Thomas	PSEG Nuclear
David Stellfox	McGraw-Hill
Tom Houghton	NEI
Bob Jasinski	NRC/OPA
Ron Rispoli	Entergy
Tom Carlisle	VEPCO
Daniel Williamson	Wolf Creek
Christopher Pragman	PECO Energy
Gene Beckett	TXU
Leon Whitney	NRC/NRR/SPLB
David Kabus	Energy Northwest
Eric Weiss	NRC/NRR/SPLB
Kent Sutton	NPPD
Jim Lechner	NPPD
Fleur de Peralta	Tri-En corp
Michael Werner	NSP
James Gregerson	Southern California Edison
Dan Robert	ComEd
William H. Ruland	NRC/Region I
Larry Scholl	NRC/Region I
Roy Mathew	NRR
Phil Qualls	NRR/SPLP
Alan Madison	NRC
John Hannon	NRC

List of Attendees on February 16, 2000

NAME	AFFILIATION
Steve Roessler	NRC/TTC
Nathan Lewis	NRC/TTC
Sheldon L. Trubatch	Winstan & Strawn
Jim Sumpter	NPPD
Greg Gibson	So Cal Edison Songs
Andy Robosky	VC Summer
Johnny Eads	CP&L
Les Bailey	Southern Nuclear
David F. Wilson	Rochestery Gas & Electric
David J. Conti	NAESCO
Eric Jebsen	ComEd
Larry Scholl	NRC
Tom Cleary	Northeast Utilities
Steve Hardy	CP&L
Roger Sims	CP&L
Brian Thomas	PSEG Nuclear
Richard Bashall	Proto-Power Corp
David Kabus	Energy Northwest
Daniel J. Robert	ComEd
Tom Carlisle	VEPCO
Daniel Williamson	Wolf Creek
Christopher Pragman	PECO Energy
J. E. Lechner	NPPD/CNS
Gene Beckett	TXU
Eric Weiss	NRC/NRR/SPLB
Leon Whitney	NRC/NRR/SPLB
Cyrus Anderson	SoCal Edison/SONGS
Stephen Dinsmore	NRC/NRR/SPSB
Peter Koltay	NRC
Alan Madison	NRC
Fred Emerson	NEI
John Hannon	NRC
Ron Rispoli	Entergy

ATTACHMENT 71111.05

NEI Comments 2-11-00

INSPECTABLE AREA:	Fire Protection
CORNERSTONES:	Initiating Events (10). Mitigating Systems (90)
INSPECTION BASES:	Fire is generally a significant contributor to reactor plant risk. In many cases, the risk posed by fires is comparable to or exceeds the risk from internal events. The fire protection program shall extend the concept of defense in depth (DID) to fire protection in plant areas important to safety by (1) preventing fires from starting, (2) rapidly detecting, controlling, and extinguishing those fires that do occur, and (3) providing protection for structures, systems, and components important to safety so that a fire that is not promptly extinguished by fire suppression activities will not prevent the safe shutdown of the reactor plant. If DID is not maintained by an adequately implemented fire protection program, overall plant risk can increase. This inspectable area verifies aspects of the Initiating Events and Mitigating Systems cornerstones for which there are no performance indicators to measure licensee performance.
LEVEL OF EFFORT:	For one hour a month, the resident inspector will tour from two to four plant areas important to reactor safety to observe conditions related to: (1) licensee control of transient combustibles and ignition sources; (2) the material condition, operational status, and operational lineup of fire protection systems, equipment and features: and (3) the fire barriers used to prevent fire damage or fire propagation. Once a year the resident inspector will observe a plant fire drill. In addition, for one week every 3 years, in from three to five selected plant areas, an inspection

team consisting of a fire protection specialist, a reactor systems engineer, and an electrical engineer will conduct a risk-informed, onsite inspection of the DID elements used to mitigate the consequences of a fire, with emphasis on the fire protection features provided for maintaining at least one safe shutdown success path free of fire damage.

71111.05-01 INSPECTION OBJECTIVE

The inspection objective is to assess whether the licensee has implemented a fire protection program that adequately controls combustibles and ignition sources within the plant, provides adequate fire detection and suppression capability, and ensures that procedures, equipment, fire barriers, and systems exist so that the capability to safely shut down the plant is ensured.

71111.05-02 INSPECTION REQUIREMENTS

02.01 Monthly Routine Inspection. For one hour each month, the resident inspector will tour from two to four plant areas important to safety to assess the material condition of plant fire protection systems and features, their operational status~~.~~, and the operational lineup of fire protection systems or equipment. The tour should concentrate on the material condition of fire detection and suppression systems and equipment, and on passive fire protection features. For the areas selected, as applicable to the area of concern, conduct the following lines of inspection inquiry:

a. Control of Transient Combustibles and Ignition Sources

1. Observe if any transient combustible materials are located in the area. If transient combustible materials are observed, verify that they are being controlled in accordance with the licensee's administrative control procedures.

2. Observe if any welding or cutting (hot work) is being performed in the area. Verify that hot work is being done in accordance with the licensee's administrative control procedures~~.~~.

b. Fire Detection Systems. Relocated first sentence to triennial inspection guidance. [~~Verify that the fire detectors installed in the room are located near or on the ceiling.~~] Observe the physical condition of the fire detection devices and note any that show physical damage. Determine from licensee administrative systems the known operational status of the system, and verify that any observed conditions do not affect the operational capability of the system.

c. Fire Suppression Systems

1. Sprinkler Fire Suppression Systems. Relocated first sentence to triennial inspection guidance. [~~Observe that sprinkler heads are located near the ceiling and under major overhead equipment obstructions (e.g., ventilation ducts)~~.] Observe and verify that the water supply control valves to the system are open and that the fire water supply and pumping capability is operable and capable of supplying the water supply demand of the system. Observe and note any material conditions that may affect performance of the system, such as mechanical damage, painted sprinkler heads, or corrosion, etc.

2. Gaseous Suppression Systems: Relocated first sentence to triennial inspection guidance. [~~Observe that the gaseous suppression system (e.g. Halon or C02) nozzles are located near the ceiling and are not obstructed or blocked by plant equipment.~~] Observe and verify that the suppression agent charge pressure is within the normal band, extinguishing agent supply valves are open, and that the system is in the automatic mode. Observe and verify that the dampers/doors will close automatically (or their closure is otherwise assured) upon actuation of the gaseous system. Observe and verify that the room penetration seals are sealed and in good condition. Observe and note any material conditions that may affect performance of the system, such as mechanical damage, corrosion, damage to doors or dampers, open penetrations, or nozzles blocked by plant equipment.

d. Manual Fire fighting Equipment and Capability

1. Fire Extinguishers. Relocated first sentence to triennial guidance. [~~Ensure that adequate numbers and types of portable fire extinguishers are provided at designated places in or near the area being inspected, and that access to the fire extinguishers is unobstructed by plant equipment or other work related activities~~.] Observe and verify that the general condition of fire extinguishes is satisfactory (e.g., pressure gauge reads in the acceptable range. nozzles are clear and unobstructed, charge test records indicate testing within the normal periodicity).

2. Hose Stations and Standpipes. Relocated first sentence to triennial inspection guidance. [~~Observe and verify that a hose station can provide coverage for the area being inspected (maximum hose length 100 feet and an electrically safe fog~~

~~nozzle)~~]~~.~~; Observe and verify that the water supply control valves to the standpipe system are open and that the fire water supply and pumping capability is operable and capable of supplying the water flow and pressure demand. Ensure that access to the hose stations is unobstructed by plant equipment or work-related activities. Observe and verify that the general condition of hose stations is satisfactory (e.g., no holes in or chafing of the hose, nozzle not mechanically damaged and not obstructed, valve hand wheels in place).

e. Passive Fire Protection

1. Electrical Raceway Fire Barrier Systems. Observe the material condition of electrical raceway fire barrier systems (e.g. cable tray fire wraps) and determine if there are any cracks, gouges, or holes in the barrier material, that there are no gaps in the material at joints or seams, and that banding, wire tie, and other fastener pattern and spacing appears appropriate. Where the fire barrier is a wrap or blanket-type material, observe that the material has no tears, rips, or holes in any of the visible layered material, that there are no gaps in the material at joint or seam locations, and that banding spacing appears appropriate. If plant modifications have recently been conducted, establish that fire barriers removed as interference have been restored.

2. Fire Doors. Observe the material condition of the fire door in the area being inspected. Observe that selected fire doors close [~~without gapping~~] relocate [without gapping]`to annual or triennial inspection guidance, and that the door latching hardware functions securely.

3. Ventilation System Fire Dampers. Observe the condition of ~~the~~ accessible fire dampers in the areas being inspected. ~~Ensure fusible link fire dampers are not prematurely shut or obstructed.~~ Delete – this presents a safety hazard for the inspector.

4. Structural Steel Fire Proofing. Observe the material condition of the structural steel fire-proofing (fibrous or concrete encapsulation) within the areas being inspected. ~~Verify that this material is installed and that the structural steel is uniformly covered.~~ Delete – impractical to assure uniform coverage.

5. Fire Barrier Electrical Penetration Seals. Tour plant areas being inspected and observe accessible electrical and piping penetrations. Observe whether any seals are missing from locations in which they appear to be needed to complete a fire barrier, and determine that seals appear to be properly installed and in good condition. Observe that fire resistive material has been used to fill the opening/penetration.

f. Compensatory measures. Verify that adequate compensatory measures are put in place by the licensee, in accordance with administrative controls, and consistent with the plant licensing basis, for degraded or inoperable fire protection equipment, systems or features (e.g., detection and suppression systems and equipment, passive fire barrier features, or safe shutdown functions or capabilities). ~~Refer to: Information Notice 97-48 "Inadequate or Inappropriate Interim Fire Protection Compensatory Measures," July 9. 1997; and NRC Internal Memorandum dated August 17, 1998. from John N. Hannon to Arthur T. Howell titled "Response to Region IV Task Interface Agreement (TIA) (96T1A008) - Evaluation of Definition of Continuous Fire Watch (TAC No. M96550)."~~ Delete – use of internal memoranda and Information Notices inappropriate for inspection guidance

02.02 Annual Routine Inspection. During the annual observation of a fire brigade drill (or an actual event) in a plant area important to safety, the resident inspector should observe that

a. Protective clothing/turnout gear is properly donned.

b. Self-contained breather apparatus (SCBA) equipment is properly worn and used.

c. Fire hose lines are capable of reaching all necessary fire hazard locations, that the lines are laid out without flow constrictions, the hose is simulated being charged with water, and the nozzle is pattern (flow stream) tested prior to entering the fire area of concern.

d. The fire area of concern is entered in a controlled manner (e.g., fire brigade members stay low to the floor and feel the door for heat prior to entry into the fire area of concern).

e. Sufficient fire fighting equipment is brought to the scene by the fire brigade to properly perform their firefighting duties.

f. The fire brigade leader's fire fighting directions are thorough, clear, and effective.

g. Radio communications with the plant operators and between fire brigade members are efficient and effective.

h. Members of the fire brigade check for fire victims and propagation into other plant areas.

i. Effective smoke removal operations were simulated.

j. ~~The fire fighting pre-plan strategies were utilized.~~ Delete – this should be covered

during training, not during a drill.

k. The licensee pre-planned the drill scenario was followed, and that the drill objectives acceptance criteria were met.

02.03 Triennial Inspection. Every three years in from three to five selected plant areas an inspection team will conduct a one-week inspection of the licensee's fire protection program with emphasis on post-fire safe shutdown capability and the fire protection features provided for ensuring that at least one post-fire safe shutdown success path is maintained free of fire damage.

a. Inspection Preparation

1. Prior to the inspection information gathering trip, the regional senior reactor analyst (SRA) will provide the team leader with a summary of plant specific fire risk insights (e.g., fire risk ranking of the rooms/plant fire areas, conditional core damage probabilities (CCDPs) for those rooms and areas, and transient sequences for these rooms). After considering the focus of past fire protection and post-fire safe shutdown inspections, the team leader will select three to five areas important to risk for team attention.

2. The inspection team leader will manage and coordinate a two or three day information gathering site visit accompanied by the team members. The fire protection and post-fire safe shutdown information gathered by the team will center on the three to five areas selected by the team leader. During the reactor site visit all team members will receive site specific site access training and will be processed for unescorted site access.

3. After the information gathering site visit, the team leader will use the SRA developed fire risk insights, as well as technical input from the other team members, to develop an inspection plan addressing (for the selected three to five plant areas, rooms or zones) post-fire safe shutdown capability and the fire protection features ~~provided~~ for maintaining one ~~train~~ success path of this capability free of fire damage. changes consistent with SDP

b. Inspection Conduct. For the plant areas selected for review, conduct the following inspection efforts:

1. Systems Required to Achieve and Maintain Post-fire Safe Shutdown

The verifications in item 1 should apply only to changes made since the previous inspection. The inspector should not completely reverify these design bases.

Verify that the licensee's shutdown methodology has properly identified the components and systems necessary to achieve and maintain safe shutdown conditions.   This requires verifying the following:

(a) The reactivity control function is capable of achieving and maintaining cold shutdown reactivity conditions.

(b) The reactor coolant makeup function is capable of maintaining the reactor coolant level above the top of the core for boiling water reactors (BWRs) [this requirement applies only to alternative shutdown capability (III.L) not to redundant shutdown capability] or within the level indication in the pressurizer (or solid plant) for pressurized water reactors (PWRs).

(c) The reactor heat removal function is capable of achieving and maintaining decay heat removal.

(d) The process monitoring equipment provides direct readings of the process variables for reactivity control, coolant makeup, and decay heat removal functions [note: source range neutron indication is not necessarily required, and an alternative method of reactivity measurement can be provided].

(e) The support system functions are capable of providing the process cooling, lubrication, and other services necessary to permit extended operation of the equipment used to accomplish safe shutdown functions.

2. Fire Protection of Safe Shutdown Capability

[This is redundant to the phrase "For the plant areas selected for review" at the major heading "b. Inspection Conduct." ~~For the plant areas selected, evaluate~~ Evaluate the separation of systems necessary to achieve safe shutdown, and verify that fire protection features are in place to satisfy the separation and design requirements of Section III.G of Appendix R (or, for reactor plants reviewed under the Standard Review Plan, license specific requirements).

Verify that the fire detectors and automatic fire suppression systems, associated with 1-hour fire barriers and/or 20 foot areas free of intervening combustibles required by Section III.G.2 of Appendix R (or. for reactor plants reviewed under the Standard Review Plan, license specific requirements), have been adequately installed. Verify that the fire detectors are installed in the room ~~are located near or on the ceiling~~are installed per the design basis. Observe that sprinkler heads are ~~located near the ceiling~~ installed per the design basis and under major overhead equipment obstructions (e.g., ventilation ducts).- Observe that the gaseous suppression system (e.g. Halon or C02) nozzles are ~~located near the ceiling~~installed per the design basis and are not obstructed or blocked by plant equipment. Ensure that adequate numbers and types of portable fire extinguishers are provided at designated places in or near the area being inspected, and that access to the fire extinguishers is unobstructed by plant equipment or other work related activities. Observe and verify that a hose station can provide coverage for the area being inspected (maximum hose length 100 feet and an electrically safe fog nozzle). Review licensee evaluations which confirm, and verify through observation in the reactor plant, that selected installed automatic suppression systems would ~~adequately suppress fires associated with the hazards of each selected area~~ meet the plant licensing basis.

For the plant areas selected, verify that redundant trains of systems required for hot shutdown located in the same fire area are not subject to damage from fire suppression activities or from the rupture or inadvertent operation of fire suppression systems. Determine ~~each of the following~~ plant compliance with its licensing basis in each of the following areas::

(a) ~~Whether a~~A fire in a single location ~~could,~~ indirectly, through the production of smoke, heat, or hot gases, ~~cause~~ causing activation of potentially damaging fire suppression for all redundant trains,

(b) ~~Whether a~~ A fire in a single location (or inadvertent actuation or rupture of a fire suppression system) ~~could,~~ through local fire suppression activity, indirectly ~~cause~~ causing damage to all redundant trains (e.g.. sprinkler-caused flooding of other than the locally affected train), and

(c) ~~Whether, in~~In response to a fire in a single location, the utilization of manually controlled fire suppression systems ~~could cause~~ causing damage to all redundant trains.

[It is inappropriate to ask open-ended “could” questions during a risk-informed inspection. The inevitable “yes” answer does not address potential risk. The inspector should focus on evaluating whether the plant meets its licensing basis in these areas.]

For the plant areas selected, verify the adequacy [how, using what criteria?] of the design of fire area boundaries (i.e.. able to contain the fire hazards of the area), raceway fire barriers, equipment fire barriers, and fixed fire detection and suppression systems. Observe that selected fire doors close without gapping.

~~Address~~ Evaluate licensee ability to carry out operator recovery actions (e.g., smoke removal, dewatering of spaces, controlled re-energization, and return to service of equipment in fire-affected areas) for fires in each plant area.

~~The observation of a fire brigade drill for a simulated fire in a plant area important to risk may be necessary to assess the effectiveness of manual fire fighting capability.~~ [Already covered under annual inspections.]

~~Verify that adequate compensatory measures are put in place by the licensee for degraded or inoperable fire protection equipment, systems or features (e.g., detection and suppression systems and equipment, passive fire barrier features,~~

~~or safe shutdown functions or capabilities)~~ [Already covered by monthly resident inspections.]

3. Post-fire Safe Shutdown Circuit Analysis

Verify that safety-related and non-safety related cables for equipment in selected fire areas have been identified by the licensee and analyzed to show that they would not prevent safe shutdown because of hot shorts, open circuits, or shorts to ground. Inspect the licensee's electrical systems and electrical circuit analyses with respect to the following:

(a) Common Power Supply/Bus Concern. On a sample basis, for associated circuits located in the fire area of concern, verify that the licensee has addressed the potential cumulative effect of simultaneous (multiple) high impedance faults which may adversely affect the availability of post-fire safe shutdown power supplies.

(b) Common Enclosure Concern. On a sample basis, review electrical fault protection from nonessential circuits routed in common enclosures (e.g. fire wrapped electrical raceways) with required safe shutdown circuits.

(c) Spurious Signal Concern. On a sample basis review fire-induced hot shorts, shorts to ground, and open circuits and their potential effects on post-fire safe shutdown capability.

(d) Fuse/Breaker Coordination. On a sample basis, verify that circuit breaker coordination and fuse protection have been analyzed and provided.

4. Alternative Shutdown Capability

Verify the adequacy of the design and implementation of the licensee's alternative shutdown capability for selected plant areas by reviewing the licensee's alternative shutdown methodology and determining the identified components and systems necessary to achieve and maintain safe shutdown conditions. Establish that these components and systems can meet the following functional requirements:

(a) The reactivity control function is capable of achieving, monitoring, and maintaining cold shutdown reactivity conditions.

(b) The reactor coolant makeup function is capable of maintaining the reactor coolant level above the top of the core for BWRs, or is within the level indication in the pressurizer (or solid plant) for PWRs.

(c) The reactor heat removal function is capable of achieving and maintaining decay heat removal.

(d) The process monitoring equipment provide direct readings of the process variables for reactivity control, coolant makeup and decay heat removal functions [note: source range neutron indication is not necessarily required, and an alternative method of reactivity measurement can be provided], and

(e) The support system functions are capable of providing the process cooling, lubrication, and other services necessary to permit extended operation of the equipment used to provide safe shutdown functions.

Verify that hot and cold shutdown from outside the control room can be achieved and maintained with off-site power available or not available. Note that a loss of offsite power need not be assumed unless caused by a specific fire.

Verify that the transfer of control from the control room to the alternative location has been demonstrated to not be affected by fire-induced circuit faults (e.g. by the provision of separate fuses and power supplies for alternative shutdown control circuits).

5. Operational Implementation of Alternative Shutdown Capability

~~Verify that the training program for licensed and non-licensed personnel~~ [which non-licensed personnel?] ~~has been expanded to include~~ includes ~~alternative or dedicated safe shutdown capability.~~ This is not necessary because it is evaluated under INPO's accredited training program.

Verify that personnel required to achieve and maintain the plant in hot shutdown following a fire using the alternative shutdown system can be provided from normal onsite staff, exclusive of the fire brigade.

Verify that adequate procedures for use of the alternative shutdown system exist. Verify that the operators can reasonably be expected to perform the procedures within applicable shutdown time requirements. Ensure that adequate communications are available for the personnel performing alternative or dedicated safe shutdown. Verify the implementation and human factors adequacy of the alternative shutdown procedures by "walking through" of the procedural steps.

Verify that the licensee conducts periodic operational tests of the alternative shutdown transfer capability and control functions, and that these tests are adequate to show that if called upon, the alternative shutdown capability would be functional upon transfer.

Verify that the licensee periodically performs operability testing of the alternative shutdown instrumentation and transfer and control functions. In addition, verify that if the licensee imposes the appropriate compensatory measures during periods in which alternative shutdown capability may be declared inoperable in accordance with plant procedures.

6. Communications

Verify through observation of licensee conducted communication tests that ~~portable radio communications and/or fixed emergency~~ communications systems are available, operable, and adequate for the performance of alternative safe shutdown functions. Assess the ability of the communication systems to support the operators in the conduct and coordination of their required actions (e.g., consider ambient noise levels, clarity of reception, reliability, coverage patterns, and survivability).

7. Emergency Lighting

Review emergency lighting provided for alternative safe shutdown along access routes and egress routes, and at control stations, plant parameter monitoring locations, and manual operating stations:

(a) If emergency lights are powered from a central battery or batteries. Verify that the distribution system contains protective devices so that a fire in the area will not cause loss of emergency lighting in any unaffected area needed for safe shutdown operations.

(b) Review the manufacturer's information to verify that battery power supplies are rated with at least an 8-hour capacity, or in accordance with the plant's licensing basis.

(c) Determine if the operability testing and maintenance of the lighting units follow the ~~manufacturer's recommendations~~ licensee procedures.

(d) Verify that sufficient illumination is provided to permit access for the monitoring of safe shutdown indications and/or the proper operation of safe shutdown equipment. ~~In coordination with the licensee, observe a normal station lighting blackout condition test in selected plant locations (e.g., remote shutdown panel, switchgear room, diesel generator area).~~

[Blackout tests involve a personnel hazard.] Determine if illumination is adequate to perform required shutdown actions.

(e) Verify that emergency lighting unit batteries are being properly maintained (observe the unit's lamp or meter charge rate indication, and specific gravity indication).

(f) Review the preventive maintenance surveillance procedure used for periodic checks of the emergency lights and verify that the maintenance frequencies and procedures are as specified by the manufacturer. Verify that the lighting units are routinely tested~~, and the testing criteria include a "as-found" manufacturers recommended discharge test~~.

8. Cold Shutdown Repairs

Verify that the licensee has dedicated repair procedures, equipment, and materials to accomplish repairs of damaged components required for cold shutdown, that these components can be made operable, and that cold shutdown can be achieved within time frames specified by Appendix R to 10 CFR Part 50 (or, for reactor plants reviewed under the Standard Review Plan. license specific requirements). Verify that the repair equipment, components, tools, and materials (e.g., pre-cut cable connectors with prepared attachment lugs) are available on site.

9. Reactor Coolant Pump Oil Collection Systems

If applicable, verify that the licensee has installed a reactor coolant pump oil collection system which is designed to and does collect oil leakage and spray from all potential reactor coolant pump oil system leakage points.

71111.05-03 INSPECTION GUIDANCE

Descriptions in this section of what is to be inspected are repetitive and should be integrated with similar information is previous sections.

General Guidance

Resident Inspector Routine Monthly Inspection. The main focus of the resident inspector's activities is on the material condition and operational status of fire detection and suppression systems and equipment, and fire barriers used to prevent fire damage or fire propagation. The two to four plant areas to be inspected will be selected on the basis of the plant-specific risk information matrix, or the generic RIM2 document for the subject reactor plant.

Triennial Inspection

Objective. The one week, onsite, triennial inspection is primarily a risk-informed look at the mitigation elements of fire protection defense in depth

(DID) (i.e., detection, suppression. and confinement of fires through passive barriers, and the fire protection features and procedures which establish the licensee's ability to achieve and maintain post-fire safe shutdown conditions during and after a fire). The triennial inspection is uniquely that portion of the baseline inspection program that focuses on the design of reactor plant fire protection and post-fire safe shutdown systems, features, and procedures. The inspection team leader will manage and coordinate the conduct of an inspection emphasizing post-fire safe shutdown. The team will use plant-specific risk, event, and technical information (including the results of licensee self-assessments) to confirm that at least one train of safe shutdown equipment (capable of providing reactivity control, reactor coolant makeup, reactor heat removal, and process monitoring and support functions) is free of fire damage.

Post-fire Safe Shutdown Capability Inspection Topics. The confirmation of reactor plant post-fire safe shutdown capability includes (1) the identification of safe shutdown systems required to achieve the performance goals for the reactor plant's necessary shutdown functions: (2) identification and design adequacy of physical separation (e.g., fire barriers) and suppression schemes used by the licensee to protect redundant cables or components (e.g., 3-hour barriers, 1-hour barrier/detection/suppression combinations, 20 feet free of intervening combustibles/detection/suppression combinations, exemption approved unique separation and suppression configurations); (3) review of the rating and physical condition of fire area boundaries to ensure their adequacy to contain the fire hazards within each fire area: (4) analysis of potential fire damage to power, control and indication cables for required systems so as to establish their continued ability to perform their intended functions (5) review of electrical control transfer mechanisms for alternative safe shutdown capabilities at remote shutdown panels and/or emergency control stations (typically for postulated main control room and cable spreading room fires); (6) review of alternative or dedicated post-fire safe shutdown procedures; equipment access, communications and manual actions; (7) review of licensee circuit analyses for required and associated circuits of concern that could interfere with post-fire safe shutdown; and (8) review of cold shutdown equipment repair procedures, tools, and materials; (9) review of emergency lighting systems ~~for access, egress and~~ to conduct ~~of~~ safe shutdown actions; and. as applicable (10) review of reactor coolant pump oil (leakage) collection capability.

Inspection Approach. The inspection of its post-fire safe shutdown capability and its associated fire protection features ~~can be either~~ is plant area-based ~~or safe shutdown system-based, depending on the structure of the licensee's analysis~~.

Inspection Team and Responsibilities. The team assigned to conduct the multi-disciplinary triennial fire protection inspection will be comprised of a fire protection inspector, an electrical inspector, and a reactor systems/mechanical systems inspector.

1. Reactor Systems/Mechanical Systems Inspector (RSI). ~~The reactor systems/mechanical systems inspector (RSI) will assess the capability of reactor and balance-of-plant systems, equipment, operating personnel, and procedures to achieve and maintain post-fire safe shutdown and minimize the release of radioactivity to the environment in the event of fire.~~ [State qualifications only. The rest should be integrated with the previous section.] He will be knowledgeable regarding integrated plant operations, maintenance, testing, surveillance and quality assurance, reactor normal and off-normal operating procedures, and BWR and/or PWR nuclear and balance-of-plant systems design.

2. Electrical Inspector (EI). [State qualifications only. The rest should be integrated with the previous section.] ~~The EI will identify electrical separation requirements 'for redundant train power, control, and instrumentation cables. He will verify that the licensee has adequately demonstrated that fire-induced circuit failures (hot shorts, shorts to ground. and open circuits) will not prevent safe shutdown operation. He will review alternative shutdown panel electrical isolation design to establish the panels' electrical independence from postulated fire areas. He will also review required and associated circuits of concern for the elimination of fire-induced faults that can cause spurious signals which could interfere with post-fire safe shutdown, and in regard to common enclosure concerns and common power supply concerns.~~ He will be knowledgeable regarding reactor plant electrical and instrumentation and control (I&C) design and will be familiar with industry ampacity derating standards

3. Fire Protection Inspector (FPI). [State qualifications only. The rest should be integrated with the previous section.] ~~The FPI will work with other team members in determining the effectiveness of the fire barriers and systems that establish the reactor plant's post-fire safe shutdown configuration and maintain it free of fire damage. He will determine whether suitable fire protection features (suppression, separation distance, fire barriers, etc.) are provided for the separation of equipment and cables required to ensure plant safety.~~ He will be knowledgeable regarding reactor plant fire protection systems, features and procedures.

Regulatory Requirements and Licensing Bases. The regulatory requirements and licensing bases against which post-fire safe shutdown capability is assessed are as follows:

1. Plants licensed before January 1. 1979. Effective February 17, 1981, the NRC amended its regulations by adding Section 50.48 and Appendix R to 10 CFR Part 50 to require certain provisions for fire protection in nuclear power plants licensed to operate before January 1. 1979. This action was taken to resolve certain contested generic issues in fire protection safety evaluation reports (SERs) and to require all applicable

licensees to upgrade their plants to a level of fire protection equivalent to the technical requirements in Sections III.G. J, L. and O of 10 CFR Part 50,

Appendix R. Licensees were required to meet the separation requirements of Section III.G.2, the alternative or dedicated shutdown capability requirements of Sections III.G.3 and III.L, or to request an exemption in accordance with 10 CFR 50.48. Alternative or dedicated safe shutdown capabilities were required to be submitted to the Office of Nuclear Reactor Regulation (NRR) for review. NRR approvals are documented in SERs.

2. <u>Plants licensed after January 1, 1979</u>: These plants are subject to requirements similar to those in 10 CFR Part 50, Appendix R, as specified in the conditions of their facility operating license, commitments made to the NRC, or deviations granted by the NRC. These reactor plants licensed after January 1, 1979, are subject to 10 CFR 50.48 (a) and (e) only.

   The fire hazards analysis (FHA) ("Fire Protection Review. Fire Protection Evaluation") document of the reactor plants licensed after January 1. 1979, may have been reviewed under Appendix A to Branch Technical Position APCSB 9.5-1. "Guidelines for Fire Protection for Nuclear power Plants Docketed Prior to July 1. 1976." of August 23. 1976 (in which case, the licensee conducted an Appendix R comparison and justified final safety analysis report (FSAR) or FHA differences from the specific provisions of Appendix R). It is possible also that licensee submittals for plants licensed after January 1, 1979, were reviewed under the Standard Review Plant, NUREG-0800, and Branch Technical Position (BTP) CMEB 9.5-1 (formerly BTP ASB 9.5-1). "Guidelines for Fire Protection for Nuclear Power Plants." Rev 2 (July 1981) (in which case, licensee submittals were reviewed according to requirements that closely paralleled the provisions of Appendix R).

   The actual fire protection requirements applicable to a given reactor plant licensed after January 1. 1979, arise from the specific license conditions in the facility operating license. These license conditions possibly refer to SERs and their supplements. Section 9.5 of such an SER delineates which licensee submittals were reviewed (e.g.. a fire hazards analysis would be such a submittal). The plant configurations and procedures described in these submittals are requirements of the license.

<u>Inspection Process</u>

1. <u>Licensee Notification Letter</u>. The licensee should be notified of the triennial inspection in writing at least three months in advance of the onsite week. The letter should discuss the scope of the inspection, request an information-gathering visit to the licensee reactor

site/engineering offices, discuss documentation and licensee personnel availability needs during the onsite inspection week, and request a pre-inspection conference call to discuss administrative matters and finalize inspection activity plans and schedules. A template for an NRC to licensee triennial fire protection baseline inspection notification letter is provided as Attachment 2.

- Information-gathering Site Visit. The inspection team leader will manage and coordinate a two to three day information gathering site visit accompanied by the team members. The purposes of the information gathering site visit are to (1) gather site-specific information important to inspection planning, (2) conduct initial discussions with licensee representatives regarding administrative items and inspection activity plans and schedules, and (3) have the team members receive site specific access training and badging for unescorted site access. In advance of the information-gathering site visit, and in order for the onsite information exchange to be as effective as possible, the team leader should provide the licensee with a list of information and documents that may be needed for the team to prepare for and conduct the triennial inspection, as well as a list of any planned requests for licensee conducted evolutions (e.g., emergency lighting tests, communication tests. fire drills, shutdown walkthroughs. etc.).

3. Information Required. The team members should gather sufficient information to become familiar with the following:

(a) The reactor plant's design, layout, and equipment configuration.

(b) The reactor plant's current post-fire safe shutdown licensing basis through review of 10 CFR 50.48, 10 CFR Part 50 Appendix R (if applicable). NRC safety evaluation reports (SERs) on fire protection, the plant's operating license, updated final safety analysis report (UFSAR), and approved exemptions or deviations.

(c) The licensee's strategy and methodology, and derivative procedures, for accomplishing post-fire safe shutdown conditions. Among the sources of information are the updated final safety analysis report (UFSAR), the latest version of the fire hazards analysis (FHA), the latest version of the post-fire safe shutdown analysis (SSA), fire protection/post-fire safe-shutdown related 10 CFR 50.59 and Generic Letter 86-10 review documentation and modification packages, plant drawings, emergency/abnormal operating procedures, and the results of licensee internal audits (e.g.. self assessments and quality assurance (QA) audits in the fire protection and post-fire safe shutdown areas).

(d) The historical record of plant-specific fire protection issues through review of plant-specific documents such as previous NRC inspection results, internal audits performed by the reactor licensee (e.g.. self-assessments and quality assurance audits), corrective action system records, event notifications submitted in accordance with 10 CFR 50.72, and licensee event reports (LERs) submitted in accordance with 10 CFR 50.73.

(e) The safe shutdown systems and support systems credited by the licensee's analysis for each fire area, room, or zone for accomplishing of the required shutdown functions (e.g., reactivity control, reactor coolant makeup, reactor heat removal, and process monitoring and support functions) as necessary to comply with the safe shutdown requirements of 10 CFR 50.48(a) and plant-specific licensing requirements. The shutdown logic for each area, room, or zone to be inspected must be thoroughly understood by the team members.

(f) The licensee's analytical approach for electrical circuits separation analyses, and the licensee's methodology for identification and resolution of associated circuits of concern. The team's electrical review should include addressing the assumptions and boundary conditions used in the performance of the licensee's analyses.

4. Significance Determination Process (SDP). The inspection team may identify a finding or set of findings that call into question one or more elements of defense in depth (DID) at the reactor plant. In order to make a determination of the significance of the finding(s), it may be necessary to evaluate them within the significance determination process in the referenced supplemental fire protection supplemental inspection procedure (the "Fire Protection Risk Significance Screening Methodology" of IP XXXXX). Review relevant licensee engineering analyses or evaluations before beginning SDP reviews of potential issues. The results of such significance evaluations can be used to help the team leader to (1) develop the in-process information necessary to prioritize and focus further onsite inspection activities, and (2) characterize the significance of triennial team inspection findings both during and after the site exit meeting with the licensee.

Specific Guidance

03.01 Inspection Requirement 02.01. The resident inspector should not attempt to address all plant areas each month. The monthly plant tour should focus on from two to four plant areas important to risk. The resident inspector should note transient combustibles and ignition sources (and compare these with the

limits provided in licensee administrative procedures). The resident inspector should also note the material condition and operational status (rather than on the design) of fire detection and suppression systems, and fire barriers used to prevent fire damage or fire propagation.

The inspector may identify a finding or set of findings which call into question one or more elements of defense-in-depth at the reactor plant. In order to assess the degree of degradation of the DID element(s), and make a determination of the significance of the finding(s), it may be necessary to evaluate them within the significance determination process of the referenced supplemental fire protection supplemental inspection procedure (the "Fire Protection Risk Significance Screening Methodology" of IP XXXXX).

~~03.02 Inspection Requirement 02.O1f. Short term compensatory measures should be adequate to compensate for the degraded function or feature until appropriate corrective action can be taken.~~Integrate this with Section 02.01f.

03.03 Inspection Requirement 02.03a3. The inspection plan issued by the team leader for the triennial inspection should consider or contain the following:

1. Recognition of the limitations imposed by the short (1 week) duration of the triennial inspection site visit.

2. The adequacy of the time allocated for the conduct of inspection efforts to gather information required for the application of the Fire Protection Risk Significance Screening Methodology contained in the reference supplemental fire protection inspection procedure (see section 03.01 above).

3. Follow-up on results of recent fire protection inspections. If it is determined that corrective actions for specific risk-important inspection findings from such inspections appear to be deficient or inadequate.

03.04 Inspection Requirement 02.03b2: Short term compensatory measures should be adequate to compensate for the degraded function or feature until appropriate corrective action can be taken.

71111.05-04 RESOURCE ESTIMATE

This procedure is estimated at 13 hours per year for routine inspection and 108 hours every 3 years for the triennial inspection

71111.05-05 REFERENCES

t

IP XXXXX, "Fire Protection Supplemental Inspection" Month ##, 1999.

ATTACHMENT 1
ROUTINE INSPECTION GUIDANCE TABLE

CORNERSTONE	RISK PRIORITY	EXAMPLES
INITIATING EVENTS (10)	Equipment or actions that could cause or contribute to initiation of fires in plant areas important to safety or near equipment required for safe shutdown,	Transient combustibles (rags, wood, ion exchange resin, lubricating oil, or Anti-Cs) are not in areas where transient combustibles are prohibited. Transient combustible amounts in other areas do not exceed administrative controls. Ignition sources (welding. grinding, brazing, flame cutting) have a fire watch. Planning includes precautions and additional fire prevention measures where these activities are near combustibles.
MITIGATING SYSTEMS (90)	Functionality of fire barriers in plant areas important to safety, Functionality of detection Systems in plant areas important to safety. Functionality of automatic suppression systems in plant areas important to safety. Fire brigade manual suppression effectiveness. Compensatory measures for degraded fire detection systems~~.~~, fire suppression features. and barriers to fire propagation	Doors and dampers that prevent the spread of fires to/or between plant areas important to safety remain in place and are functional Electrical raceway fire barriers and penetration seals that protect the post-fire safe shutdown train are not damaged. Fire detection and alarm system is functional for plant areas Important to safety. Automatic suppression system sprinklers are functional and their sprinkler head patterns are not blocked by plant equipment. Fire brigade performance indicates a prompt response with proper fire fighting techniques for the type of fire encountered. Manual fire suppression equipment is of the proper type and has been tested. Degraded fire detection equipment, suppression features and fire propagation barriers are adequately compensated for on reasonably short-term bases.

END

ATTACHMENT 2

Mr. . President
Licensee Nuclear Department
Licensee Corporation or Company
Address

SUBJECT: SELECTED NUCLEAR POWER STATION. UNITS 1 AND 2 - NOTIFICATION OF CONDUCT OF A TRIENNIAL FIRE PROTECTION BASELINE INSPECTION

Dear Mr.

The purpose of this letter is to notify you that the U.S. Nuclear Regulatory Commission (NRC) Region # staff will conduct a triennial fire protection baseline inspection at Selected Nuclear Power Station, Units 1 and 2 in Month. 20##. The inspection team will be lead by First Last, a fire protection specialist from the NRC Region # Office The team will be composed of personnel from NRC Region #. and Contracted National Laboratory. The inspection will be conducted in accordance with IP 71111.05, the NRC's baseline fire protection inspection procedure.

The schedule for the inspection is as follows:

- Information gathering visit - Month ##-##. 20## [Note - this date is pre-coordinated with the licensee]
- Week of onsite inspection - Month ##. 20##.

The purposes of the information gathering visit are to obtain information and documentation needed to support the inspection, to become familiar with the Selected Nuclear Power Station, Units 1 and 2 fire protection programs, fire protection features, and post-fire safe shutdown capabilities and plant layout, and, as necessary, obtain plant specific site access training and badging for unescorted site access. A list of the types of documents the team will be interested in reviewing, and possibly obtaining, are listed in Enclosure 1.

During the information gathering visit, the team will also discuss the following inspection support administrative details: office space size and location; specific documents requested to be made available to the team in their office spaces; arrangements for reactor site access (including radiation protection training, security, safety and fitness for duty requirements); and the availability of knowledgeable plant engineering and licensing organization personnel to serve as points of contact during the inspection.

We request that during the onsite inspection week you ensure that copies of analyses, evaluations or documentation regarding the implementation and maintenance of the Selected Nuclear Generating Station, Units 1 and 2 fire protection program, including post-fire safe shutdown capability, be readily accessible to the team for their review. Of specific interest are those documents which establish that your fire protection program satisfies NRC regulatory requirements and conforms to applicable NRC and industry fire protection guidance. Also, personnel should be available at the site during the inspection who are knowledgeable regarding those plant systems required to achieve and maintain safe shutdown conditions from inside and outside the control room (including the electrical aspects of the relevant post-fire safe shutdown analyses), reactor plant fire protection systems and features, and the Selected Nuclear Power Station fire protection program and its implementation.

Your cooperation and support during this inspection will be appreciated. If you have questions concerning this inspection, or the inspection team's information or logistical needs, please contact First Last, the team leader, in the Region # Office at ###-###-

Sincerely,

Docket Nos.:
and 50-###

Enclosure: As stated (1)

ENCLOSURE 1

Reactor Fire Protection Program Supporting Documentation

[NOTE: Limit requests for the items listed below to documents not already in the possession of

the NRC.]

1. The current version of the Fire Protection Program and Fire Hazards Analysis.

2. Current versions of the fire protection program implementing procedures (e.g., administrative controls, surveillance testing, fire brigade).

.3. Fire brigade training program and pre-fire plans.

4. Post-fire safe shutdown systems and separation analysis.

5. Post-fire alternative shutdown analysis.

6. ~~Piping and instrumentation (flow) diagrams highlighting the components used to achieve and maintain hot standby and cold shutdown for fires outside the control room and those components used for those areas requiring alternative shutdown capability.~~ [These are time-consuming to prepare and should not change much from inspection to inspection.]

7. Plant layout and equipment drawings which identify the physical plant locations of hot standby and cold shutdown equipment.

8. Plant layout drawings which identify plant fire area delineation, areas protected by automatic fire suppression and detection, and the locations of fire protection equipment.

9. Plant layout drawings which identify the general location of the post-fire emergency lighting units.

10. Associated circuit analysis performed to assure the shutdown functions and alternative shutdown capability are not prevented by hot shorts, shorts to ground, or open circuits (e.g., analysis of associated circuits for spurious equipment operations, common enclosure, common bus).

11. Plant operating procedures which would be used and describe shutdown from inside the control room with a postulated fire occurring in any plant area outside the control room, procedures which would be used to implement alternative shutdown capability in the event of a fire in either the control or cable spreading room.

12. Maintenance and surveillance testing procedures for alternative shutdown capability and fire barriers, detectors, pumps and suppression systems.

13. Maintenance procedures which routinely verify fuse breaker coordination in accordance with the post-fire safe shutdown coordination analysis.

14. A sample of significant fire protection and post-fire safe shutdown related design change packages (including their associated 10 CFR 50.59 evaluations) and Generic Letter 86-10 evaluations.

15. The reactor plant's IPEEE, results of any post-IPEEE reviews, and listings of actions taken/plant modifications conducted in response to IPEEE information.

16. Temporary modification procedures.

17. Organization charts of site personnel down to the level of fire protection staff personnel.

18. If applicable, layout/arrangement drawings of potential reactor coolant/recirculation pump lube oil system leakage points and associated lube oil collection systems.

19. The SERs and 50.59 reviews which form the licensing basis for the reactor plant's post-fire safe shutdown configuration.

20. Procedures/instructions that control the configuration of the reactor plant's fire protection program, features, and post-fire safe shutdown methodology and system design.

21 A list of applicable codes and standards related to the design of plant fire protection features and evaluations of code deviations.

22. Procedures/instructions that govern the implementation of plant modifications, maintenance, and special operations, and their impact on fire protection.

23. The three most recent fire protection QA audits and/or fire protection self-assessments.

24. Recent QA surveillances of fire protection activities.

25. Listing of open and closed fire protection condition reports (problem reports/NCRs/EARs/problem identification and resolution reports).

26. Listing of plant fire protection licensing basis documents.

27. NFPA code versions committed to (NFPA codes of record).

28. Listing of plant deviations from code commitments.

29. Listing of Generic Letter 86-10 evaluations.

NEI COMMENTS 2-14-00

APPENDIX 4

Determining Potential Risk Significance of Fire Protection and Post-fire Safe Shutdown Inspection Findings

1.0 **Introduction**

The fire protection defense-In-depth (DID) elements are

(1) Prevent fires from starting.

(2) Rapidly detect and suppress those fires that do occur

(3) Protect structures, systems, and components important to safety so that a fire that is not promptly extinguished by fire suppression activities will not prevent the safe shutdown of the plant.[1]

A fire protection program finding can generally be classified as a weakness associated with meeting the objectives of one of the preceding DID elements. As a result, the Fire Protection Risk Significance Screening Methodology (FPRSSM), a two-phase screening methodology, was developed to evaluate the potential fire risk significance of any fire protection DID weaknesses that are important to post-fire safe shutdown. If no weakness was observed in a DID element, that element should be noted as "zero degradation."

Phase 1 of the FPRSSM is a screening method that is used by the resident or regional inspector to screen out fire protection findings (e.g., impairments to any fire protection feature) that are primarily unrelated to fire protection systems and features used to protect safe shutdown (SSD) capability. Phase I is used as an oversight process to monitor operational conditions affecting fire protection systems and features. This monitoring process identifies conditions that could have a potential impact on the capability to maintain one SSD success path[2] free of fire damage.

Findings that do not screen out as result of the Phase 1 screening should be subjected to the more detailed Phase 2 analysis. The Phase 2 analysis evaluates the synergistic impact that these findings may have on risk by treating them collectively for a fire area. Because of the integrated approach taken by the Phase 2 analysis, this analysis is generally performed with technical support from NRC fire protection engineers and risk analysts, to better understand the potential fire risk significance posed by the identified DID Phase 1 findings. For those cases where Phase 2 method determines that the inspection findings have potential risk significance, Phase 3, which is a more refined analysis, can be performed.

2.0 Purpose

[1] Fire protection features sufficient to protect against the fire hazards in the area, zone, or room under consideration must be capable of assuring that necessary structures, systems, and components needed for achieving and maintaining safe shutdown are fires of fire damage (See Section III.G.2a, b, and c of Appendix R to 10 CFR Part 50); that is, the structure, system, or component under consideration is capable of performing its intended function during and after the postulated fire, as needed.

[2] [2]An SSD success path must be capable of maintaining the reactor coolant process variables within that predicted for a loss of AC power, and the fission product boundary integrity must not be effected (i.e., there must be no fuel cladding damage. rupture of any primary coolant boundary, or rupture of the containment boundary).

The purpose of this two-phase screening methodology is to (1) focus resources on monitoring the performance and effectiveness of those fire protection mitigation features that are

(1) important to protecting post-fire safe shutdown capability; (2) establish a threshold method (Phase 1 method is described In Section 4.0) that will assist in recognizing which fire protection mitigation findings may have the potential to affect post-fire safe shutdown capability; and (3) determine the potential fire risk significance of observed findings associated with fire protection mitigation features and systems used to protect SSD capability by performing screening assessment (Phase 2 method is described in Section 5.0) of the as-found condition(s). The Phase 2 screening analysis portion evaluates the "as-found" conditions associated with each fire protection mitigating element of the fire protection DID philosophy (e.g., detection, suppression, and passive protection separating post-fire SSD functions) within each of the DID elements. The potential fire risk significance of the as-found condition(s) is determined by performing an integrated assessment of the fire protection mitigation findings and the potential impact they may have on SSD capability.

The Phase 2 methodology can also be used by an NRR fire protection reviewer or a regional inspector as an aid for determining the potential risk/safety significance of: (1) a fire protection design condition that deviates from the intent of the facilities licenslng/design basis; or (2) a Generic Letter 86-10 or 10 CFR 50.59 engineering evaluation documenting a change in a licensee's fire protection program.

For the purpose of this guidance, weaknesses or findings will be defined as conclusions or factual observations of those "in-plant" conditions that do not meet regulatory requirements, do not conform to the facilities operating license fire protection condition, or are considered to have risk implications due to an inherent fire protection/post-fire safe shutdown system design weakness. However, a difference between compliance with a current code and a code of record will not be considered a design weakness if the licensee complies with the code of record.

3.0 Scope

The scope of Phase I is to present a process that can help inspectors determine whether a particular fire protection finding is important to the protection of the safe shutdown capability and has the potential of being risk significant.

Fire protection DID findings that have been determined to imply potential risk by the Phase 1 screening method are subjected to a Phase 2 review. The scope of Phase 2 is to present a process or regional and headquarters fire protection engineers and risk analysis to further evaluate how a particular fire protection DID finding or set of findings affects SSD capability. In order to evaluate the potential risk significance, Phase 2 integrates the "as-found"' degradations or findings and evaluates their potential affects on fire mitigation effectiveness and SSD capability. Phase 2 is focused on the following specific areas of fire mitigation:

- fire barrier effectiveness compared to combustible loading
- fire detection
- automatic suppression system effectiveness
- manual suppression effectiveness
- administrative controls
- safe shutdown capability

4.0 Fire Protection Risk Significance Screening Methodology – Phase 1

Not all plant fire protection systems and features are considered to be important to the protection of post-fire SSD capability. The results of the fire IPEEE (individual plant evaluation of external events) can provide a relative ranking of the plant areas that are the major contributors to fire risk. The top 10 areas identified by this IPEEE/PRA (probabilistic risk assessment) ranking are generally important to post-fire SSD. These plant areas also present the greatest challenges with respect to separation of redundant trains of post-fire SSD capability, protection of this capability, and the ability to perform the operator actions necessary to achieve and maintain post-fire SSD conditions.

Phase 1 method consists of two steps. Step 1 is a screening evaluation of a fire protection finding or a set of findings and is intended to screen out findings that do not impact the effectiveness of a fire protection DID element. For those findings that impact the effectiveness of one or more of the DID elements Step 2 is performed. Step 2 integrates the findings with the SSD capability provided for the fire area, zone, or room of concern and then presents insights with respect to the potential importance that these fire protection findings have on maintaining one success path of SSD capability free from fire damage

The steps that follow describe the general process for implementing Phase 1.

Step 1: Screening of Fire Protection Findings

The Step 1 screening process is described by Figure 4-1.This process identifies those fire protection findings that impact the mitigation effectiveness of one fire protection DID element. Findings that impact the effectiveness of one or more of the fire protection DID elements potentially have risk implications[3]. Once identified, findings affecting one or more of the DID elements require further screening In order to determine if they are potentially important to maintaining one success path of SSD capability free of fire damage. This screening is performed by Step 2 below.

Making judgments regarding how effective a fire brigade can be in extinguishing a challenging plant fire requires an evaluator to have a comprehensive understanding of manual fire fighting techniques and operations. It is not the intent of Step 1 to expect resident inspectors to have the expertise to evaluate fire brigade effectiveness and performance. In most cases, fire brigade performance can be important to mitigating a fire and reducing its potential risk and should be considered when performing a Phase 2 evaluation. Reliance on fire brigade performance and its effectiveness as a sole means of maintaining one success path of SSD capability free of fire damage is not viewed as an acceptable practice. In those cases in which manual fire fighting (i.e., fire brigade) is used as the sole means to control and extinguish a fire, one success path of SSD capability is generally maintained free of fire damage by a passive fire barrier having a fire resistive rating of 3-hours. In Step 2, where fire barriers or fire barriers in combination with an automatic fire suppression system are used as the primary protection scheme for maintaining an SSD success path free of fire damage, manual fire fighting performance or effectiveness is not considered the dominant protective element of the primary protection scheme. For those protection schemes that use passive fire barriers as primary protection, findings related to only manual firefighting or fire brigade effectiveness typically do not warrant the performance of a Phase 2 evaluation.

---

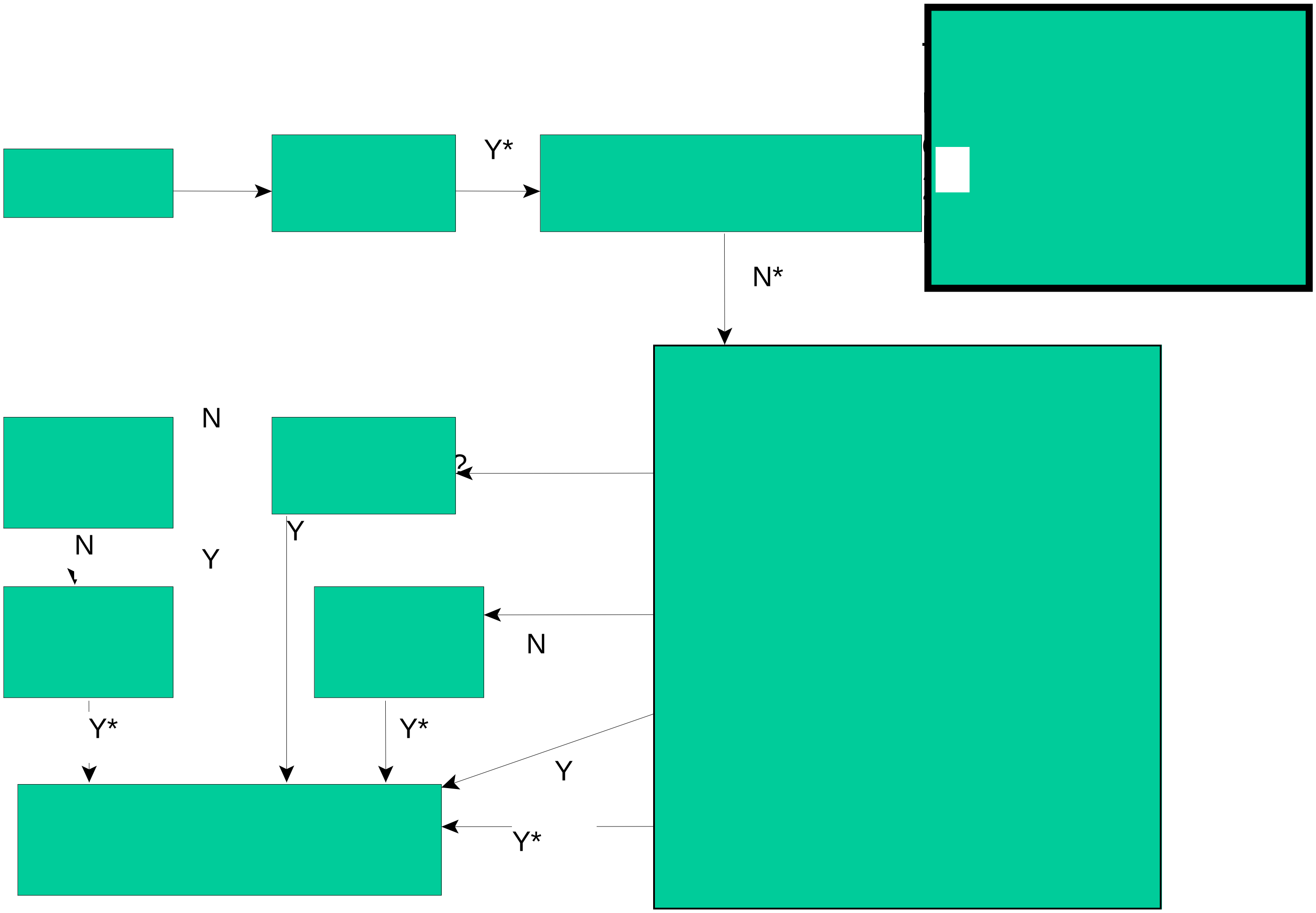
[3] Allowed outage times with the use of compensatory measures do not provide an equivalent level of fire safely to that of a fully operable fire protection system or feature. Long term use (more than 30 days) of compensatory measures for degraded or inoperable fire protection features used to protect the safe shutdown capability is an indication of inappropriate attention and resources being given to managing fire risk vulnerabilities.

Figure 4-1: Screening Process Phase 1 (Step 1)

Step 2: Safety Importance Determination

Step 2 is very complex for a first screening phase; there are four different pathways depending on barrier and recovery schemes. Industry recommends the following

- Replacing Figures 4-1 and 4-2 with that shown on the following page
- Developing similar figures for the other three pathways
- Having NRR or equivalent expertise perform all pathways, or those associated with recovery options (Figures 4-3, -4 and -5)



* means the opposite answer will result in screening out

licensee corrective action program.

Figure 4-2

The SSD determination

4 Findings that do not s ... ey should be referred to the license and placed

Determine [illegible] is used.

[illegible] or provides wall-to-wall and floor-to-floor separation bet[illegible]

[illegible]

08XX

Screening Criteria for Figure 4-2

Screening Criter

58

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59

Issue Date 08/10/99

This scheme minimizes fire

Issue Date 08/10/99

is [illegible]

Screening Criter

63

Issue Da

Figure 4-5

For the -5 above, three b

Determine

[illegible]

Table 5.1 Quantification of Degradatio

C>FB	3-Hour Barrier	-4	-2	-1	0
	1-Hour Barrier	-3	-1	-.5	0
D		-1	-.5	0	0
AS		-4	-1.25	-.75	0
MS	Control Room Outside	-2	-1	-.5	-.25
	Control Room Inside	-2	-1.5	-1	-.5
AC		-.5	0	+.25	+.5

The Table 5.3 adjustment is made since

automatic and manual water-based systems

Table 5.2 Quantification of Dependencies Between DID Elements

	Effectiveness Degradation Manual Fire Fighting	Adjustment Due to Dependency
Low	High	+0.5
Medium	High	+0.75

Table 5.3 Quantification of Common Cause Contribution Between Sprinkler Systems and Manual Fire Fighting Hose Stations

Automatic Fire Suppression Effectiveness Degradation	Manual Fire Fighting Effectiveness degradation	Adjustment Due to Common Cause
Low	Low	+.25

NRC's "Special Study, Fire Events ..."

PMF = IF + C> FB + D> + MS + AS + AC + CC (when appropriate)

Generic Ignition frequencies for specific buildings or rooms are provided in Table 4.4a (taken from AEOD data base

Table 5.4 Generic Ignition Frequencies

Building or Room	***Ignition Frequency (IF) / Yr***	***Adjusted Ignition Frequency (IF/YR)***	***Log of Ignition Frequency***
Plant Buildings or Rooms			
Containment	9E-3		-2.05
Turbine Building	6E-2		-1.2
Auxiliary Building	6E-2		-1.2
Reactor Building	3E-2		-1.5
Battery Room	3E-3 to 1E-2	7.5E-4 to 2.5E-3	-3.1 to -2.6
Switchgear Room	1E-2	2.5E-3	-2.6
Diesel Generator Building	6E-2	1.5E-2	-1.8
Cable Spreading Room	5E-3		-2.3
Control Room	7E-3		-2.15

where IF = Fire Ig

The approximate frequency (same as FMF) is adjusted in Tab

(SDP Table 1) Approxim

Table 5.6 Associatio

of Delta CDF

Fire Mitigation Frequency (FMF)	Approximate Frequencies
[illegible]	[illegible]

In the FPRSSM, the [illegible]

the [illegible] [See comment with Table 5.8] [illegible], the FMF

Table 5.7 Estim[illegible]

During Degraded F[illegible]

Exposure Time for Degraded Condition	Estimated Likelihood Rating						
> 30 days	G	F	E	D	C	B	A
30 - 3 days	H	G	F	E	D	C	B
< 3 days	H	H	G	F	E	D	C

Since a fire [illegible]

are [illegible]

~~Figu~~

~~Figure 8.1~~

08XX

Table 5.8 – Risk Si

Remaining Mitigation (from Step 2.3 of SDP)		Likelihood Initiating Event (from SDP Step 2.2)	A	B	C	D	E	F	G	H
≥3 diverse trains **OR** 2 systems each with redundancy	(1)		Green	Green	Green	Green	Green	Green	Green	Green
1 system with redundancy +1 train **OR** 2 diverse trains + recovery of failed train	(2)		White	Green	Green	Green	Green	Green	Green	Green
2 diverse trains **OR** 1 system with redundancy + recovery of failed train	(3)		Yellow	White	Green	Green	Green	Green	Green	Green
1 train + recovery of failed train OR 1 system with redundancy (automatic initiation or constrained time)	(4)		Red	Yellow	White	Green	Green	Green	Green	Green
1 train OR [illegible]	(5)		Red	Red	Yellow	White	Green	Green	Green	Green
Recovery of failed train	(6)		Red	Red	Red	Yellow	White	Green	Green	Green

Source: SDP Table 2

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Issue Date 08/10/99

Given the SSD still equals none, Thus, ...

MSS Fire automatic suppression/detection

3/yr ... automatic ... (RSP) ...

Fire Protection Risk

Hypothetical Cases

Application Of

_to_

Attachment 1

Industry will provide new and revised scenarios.

Table 5.7

[illegible]

81

'T

Issue Date 08/10/99

[illegible]

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82

Issue Date 08/10/99

the [illegible] case,

Example 2B

Revision Draft 1 (May 6,

NEI Comments 2-11-00

Evaluation Guidance
Determining Potential Risk Significance
of
Fire Protection and Post-fire Safe Shutdown Inspection Findings

Division of Systems Safety and Analysis (DSSA)
Probabilistic Risk Assessment Branch (SPSB)
Office of Nuclear Reactor Regulation (NRR)
Fire Protection Engineering Section (FPES)

Plant Systems Branch (SPLB)
Safety Programs Section

and

1.0 Introduction

[6] Fire protection features sufficient to protect against the fire hazards in the area, zone or room under

Section 8.0

4.0 Fire Protection Risk Assessment Methodology

Figure 4-1, Fire Protection Risk Significance Screening Methodology - Process Diagram).

Step 1 ***Grouping of Fire Protection and Post-fire Safe Shutdown Findings***

provides the guidance for evaluatin

Pre-decisional D

Step 2 ***Define the Fire Scenario***

Step 3 ***Qualitative Evaluation of Findings***

Step 4 ***Assignment of Quantitative Values***

degradation qualitative ratings. Fire barriers, detection/automatic suppression and manual suppression only have high, medium, or low qualitative ratings.

*Note that the ratings for safe shutdown are extra high, high, medium, and low assigning a value from loc

to the score of the fire area overall

Table 4.3 provides criteria for determining the overall DQR for the fire ar

Step 5

Table 4.2

Integrated Assessment of DID Findings

Pre-decisional D

Step 6 ***Identification of Ignition Frequency and Adjustment by Degradation Time***

to obtain an overall potential risk significance estimate

Step 7 ***Correlation of Fire Protection Findings to the Inspection Finding Risk Characterization Process***

Pre-decisional

[8] Generic ignition frequencies for specific buildings or rooms are provided in lookup table

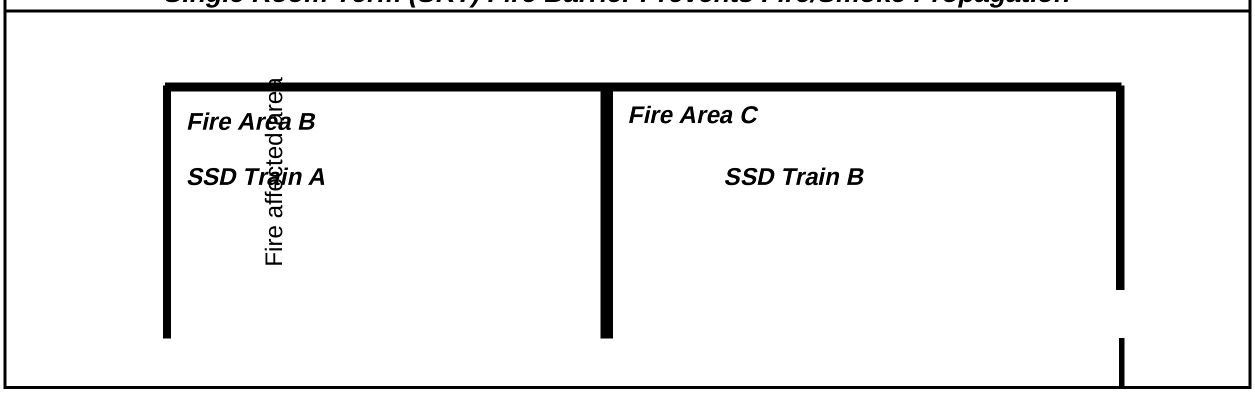
U.S. Operating Experience AEOD Report, "Special Study: Fire Events 0- Feedback of ... June 1997)

Pre-decisiona

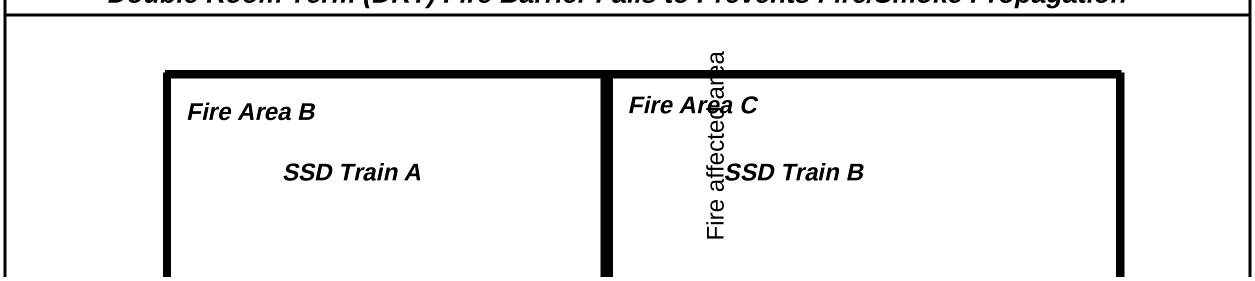
Color Characterization	Delta in Core Damage Frequency (CDF)
RED	CDF ≥ 10^{-4}
YELLOW	10^{-5} ≤ CDF < 10^{-4}
WHITE	10^{-6} ≤ CDF < 10^{-5}
GREEN	CDF < 10^{-6}

Step 8 - General Rules for Applying FPRSSM

Single Room Term (SRT) Fire Barrier Prevents Fire/Smoke Propagation



Double Room Term (DRT) Fire Barrier Fails to Prevents Fire/Smoke Propagation

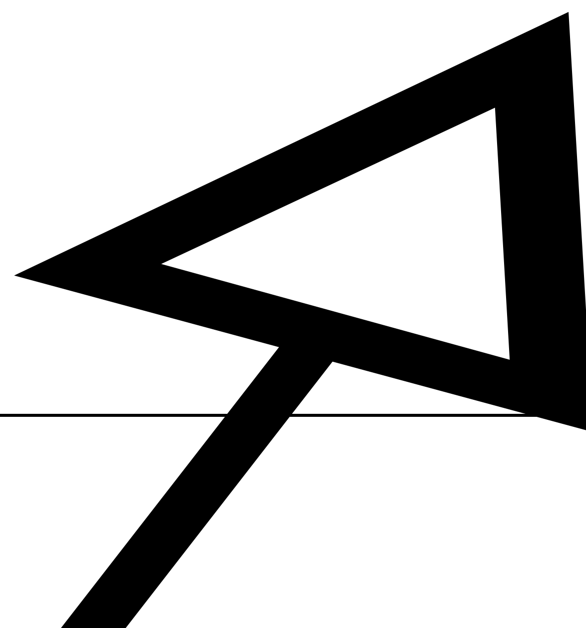


Pre-decisiona

8

Pre-decisiona

9



Pre-decisiona

10

3 hour Fire Barrier fails (Fire/s

Step 9: Adjusting the Fire Area Risk Significance Under Spurious Actuations

General Assumptions

1.

2.

3.

4.

Guidance

9 It should be noted that this type of assessment of the fuel configuration and distribution

is not the same as the fire loading (btus/sq. ft) calculations performed for the plant specific Fire Hazards Analysis (FHA).

12

__Pre-decisiona__

13

General Assumptions

1.

2.

3.

Pre-decisional

(a)

Medium Degradation Categories

High Degradation Categories

Evaluation Guidance

[illegible]

[10] The guidance table for penetration seal degradations assumes that the silicone material is mixed and its cell structure is in accordance with the manufacturers recommendations and guidelines.

(b)

~~Fire dampers insta~~

Pre-decisiona

16

Low Degradation Categories

Pre-decisiona

(d) (c) (b) (a)

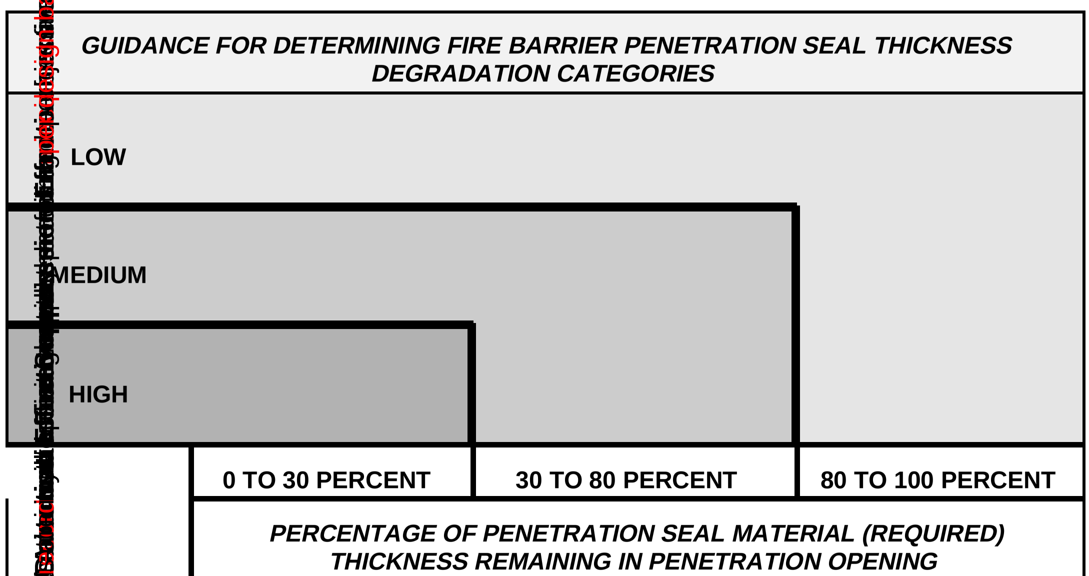
-

Pre-decisiona

18

(e) ~~Fire walls / barrier assemblies installed in accordance with the construction attributes and conditions qualified by fire tests~~

The existing (a) through (e) should not be considered degraded at all, since they are fully compliant with the licensing / design bases. They should be used to define a “Zero Degradation” category.



General Assumptions

1.

2.

4.

3.

consistent

Pre-decisiona

20

Pre-decisiona

Judging Adequacy of Spot-Type Thermal Detector Placement - Minimum Factors

Evaluation Guidance[11]

1.

2.

... thermal detector placement. This ...

... wall or on the

[11] Refer to the NFPA National Fire Alarm Code Handbook, 1993 Edition, for further guidance

3. ~~The maximum linear spacing on smooth ceilings for spot type heat (rate of rise or rate compensated) detectors are determined by full scale fire tests. These tests assume that the detectors are to be installed in a pattern of one or more squares, each side of which equals the maximum spaced as determined in the test. The distance from the detector to the fire shall be maintained always at the test spacing multiplied by 0.7. (See table below)~~

~~TEST SPACING~~	~~MAXIMUM TEST DISTANCE FROM FIRE TO DETECTOR~~
~~50 X 50 FEET~~	~~35 FEET~~
~~40 X 40 FEET~~	~~28 FEET~~
~~30 X 30 FEET~~	~~21 FEET~~
~~25 X 25 FEET~~	~~17.5 FEET~~
~~20 X 20 FEET~~	~~14 FEET~~
~~15 X 15 FEET~~	~~10.5 FEET~~

4. ... heat detector spacing shall be reduced in a

~~CEILING HEIGHT (FT)~~	~~UP TO~~	~~PERCENT OF UL LISTED SPACING~~
~~0~~	~~10~~	~~100~~
~~10~~	~~12~~	~~91~~
~~12~~	~~14~~	~~84~~
~~14~~	~~16~~	~~77~~
~~16~~	~~18~~	~~71~~
~~18~~	~~20~~	~~64~~
~~20~~	~~22~~	~~58~~
~~22~~	~~24~~	~~52~~
~~24~~	~~26~~	~~46~~
~~26~~	~~28~~	~~40~~
~~28~~	~~30~~	~~34~~

5. ceiling ...

[illegible]

Pre-decisiona

23

Pre-decisiona

~~Judging Adequacy of Spot Type POC Detector Placement - Minimum Factors~~

~~Fire Size (Btus/second) and Growth Rate~~	***~~Maximum Ceiling height (feet)~~***	***~~Maximum Spacing (ft)~~***
~~100 btus/sec - fire growing at a slow rate~~	~~10~~	~~22~~
	~~15~~	~~15~~
	~~18~~	~~12~~
~~250 btus/sec - fire growing at a slow rate~~	~~10~~	~~40~~
	~~15~~	~~35~~
	~~18~~	~~30~~
MEDIUM RATE		
~~100 btus/sec - fire growing at a medium rate~~	~~10~~	~~18~~
	~~15~~	~~12~~

~~8 It is assumed that the ratio of the gas temperature rise to the optical density~~ ... F, which is considered indicative of ~~the detector would actuate at a constant value of temperature rise equal to 20~~ ... ~~detection by a relatively sensitive detector.~~

Pre-decisiona

3.

4.

~~Fire Size (Btus/second) and Growth Rate~~	~~Maximum Ceiling height (feet)~~	~~Maximum Spacing (ft)~~
	~~18~~	~~N/A~~
~~MEDIUM RATE~~		
~~250 btus/sec - fire growing at a medium rate~~	~~10~~	~~35~~
	~~15~~	~~28~~
	~~20~~	~~24~~
	~~25~~	~~18~~
	~~28~~	~~12~~
~~FAST RATE~~		
~~100 btus/sec - fire growing at a fast rate~~	~~10~~	~~12~~
	~~15~~	~~N/A~~
~~FAST RATE~~		
~~250 btus/sec - fire growing at a fast rate~~	~~10~~	~~28~~
	~~15~~	~~20~~
	~~20~~	~~14~~

(a)

(b)

Medium Degradation Categorization

High Degradation Categorization

9 Most fires modeled as part of

Pre-decisiona

Pre-decisional

Low Degradation Categorization

7.2 Fixed / Automatic Fire Suppression Systems

7.2.1 Automatic Sprinkler Protection

General Assumptions

Compensatory measures are not viewed as risk equivalent functions and are not credited by this methodology (e.g., Additional manual fire fighting equipment staged in the area of the degraded or inoperable automatic fire suppression systems does not assure that the risk is neutral). [some credit should be given for compensatory measures, even if not full credit. This is consistent with NRC staff statements that a degraded fire barrier is better than no fire barrier.]

General Evaluation Guidance

10 Refer to Automatic

Pre-decisional

accordance with the

3.

4.

5.

6.

the hottest summer day (Summer High)

~~11 The maximum ceiling temp~~

~~Maximum Ceiling Temperature (F)~~	~~Sprinkler Temperature rating (F)~~	~~Sprinkler temperature classification~~	~~Sprinkler temperature rating~~	~~Glass bulb colors~~
~~100~~	~~135 to 170~~	~~Ordinary~~	~~Uncolored~~	~~Orange or Red~~
~~150~~	~~175 to 225~~	~~Intermediate~~	~~White~~	~~Yellow or Green~~
~~225~~	~~250 to 300~~	~~High~~	~~Blue~~	~~Blue~~
~~300~~	~~325 to 375~~	~~Extra High~~	~~Red~~	~~Purple~~
~~375~~	~~400 to 475~~	~~Very Extra High~~	~~Green~~	~~Black~~

~~Minimum distance from vertical obstruction~~	
~~Maximum dimension of obstruction~~	~~Maximum horizontal distance sprinkler shall be placed away from obstruction~~
~~½ to 1 inch~~	~~6 inches~~
~~Greater than 1 inch and less than 4 inches~~	~~12 inches~~
~~Greater than 4 inches~~	~~24 inches~~

28

Pre-decisional

shall be as follows:

7.

Position of sprinkler deflector when located above bottom of obstruction	
Distance from sprinkler to side of obstruction	Maximum allowable distance of deflector above bottom of obstruction
less than 1 ft.	0 in.
1 ft. to less than 1 ft. 6 in.	1 in.
[illegible]	1 in.
[illegible]	2 in.
[illegible]	3 in.
[illegible]	4 in.
[illegible]	6 in.
[illegible]	7 in.
4 ft. 6 in. to less than [illegible]	9 in.
5 ft. to less than [illegible]	11 in.
5 ft. [illegible]	14 in.

8.

Position of sprinklers in relation to obstruction located entirely below the sprinklers	
Distance of deflector above the bottom of the bottom of the obstruction	Minimum distance to side of obstruction (ft)
Less than 6 inches	1 ½ feet
6 inches to less than 12 inches	3 feet
12 inches [illegible]	4 feet
18 inches [illegible]	5 feet
24 inches [illegible]	6 feet

9. Sprinklers shall be positioned [illegible] Where the bottom of the obstruction is [illegible]

(a) The following are examples of medium degradation categories:

Medium Degradation Categorization

(a) The following are examples of high degradation categories:

High Degradation Categorization

Pre-decisional

(b) ~~The placement and spacing of 10 percent of the sprinklers within the fire area, zone, or room under consideration do not meet the spacing/placement conditions of their UL listing or do not meet the general assessment guidance specified above~~

~~(c) If the system is actuated by the fire detection system and the degradation categorization of the fire detection systems is medium, then the degradation categorization of the suppression system would be medium even when the degradation to the suppression system is low.~~ The system is in an unanalyzed condition.

Low Degradation Categorization

There is no "low" degradation. If the system complies with its design basis there is no degradation.

~~The following is an example of low degradation category:~~

~~(a) The sprinkler system layout and head placement within the fire area, zone, or room under consideration meets or exceeds the minimum industry code requirements and the conditions of the sprinkler head UL listing and testing approvals.~~

7.2.2. Automatic Halon Systems (LATER - UNDER DEVELOPMENT)

General Assumptions

Compensatory measures are not viewed as risk equivalent functions and are not credited by this methodology (e.g., Additional manual fire fighting equipment staged in the area of the degraded or inoperable automatic fire suppression systems does not assure that the risk is neutral).

[Some credit should be given for compensatory measures, even if not full credit. This is consistent with NRC staff statements that a degraded fire barrier is better than no fire barrier.]

General Guidance

Should be evaluated against the code of record.

High Degradation Categorization

Same as for 7.2.1

Medium Degradation Categorization

Same as for 7.2.1

Low Degradation Categorization

Same as for 7.2.1

7.2.3 Automatic Carbon Dioxide Systems (LATER - UNDER DEVELOPMENT)

General Assumptions

Compensatory measures are not viewed as risk equivalent functions and are not credited by this methodology (e.g., Additional manual fire fighting equipment staged in the area of the degraded or inoperable automatic fire suppression systems does not assure that the risk is neutral).

[Some credit should be given for compensatory measures, even if not full credit. This is consistent with NRC staff statements that a degraded fire barrier is better than no fire barrier.]

General Guidance

Should be evaluated against code of record or design basis.

High Degradation Categorization

Same as for 7.2.1

Medium Degradation Categorization

Same as for 7.2.1

Low Degradation Categorization

Same as for 7.2.1

8.0 Detection / Manual Firefighting Effectiveness

For guidance regarding how to evaluate the minimum effectiveness of the fire detection system and its ability to adequately react to a fire See section 7.1.

Manual fire fighting effectiveness under severe fire conditions is complex and difficult to assess. Generally, event history has demonstrated that when faced with a challenging fire condition the effectiveness of plant fire brigades, in the absence of assistance from either fixed plant fire protection features or offsite fire fighting support, have shown conditional limitations which have impeded their ability to be effective. For example, weaknesses in actual fire brigade performance is often a reflection of ineffective training, minimal fire brigade drill performance expectations, incomplete fire fighting strategies (pre-plans), poor fire ground communications, improper or inappropriate specialized fire fighting equipment and extinguishing agents, poor application and logistics/stagging of specialized fire fighting equipment, inappropriate staffing, poor fire ground command and control, physical limitations of individual fire brigade members, etc.

In addition, manual fire fighting is affected by several time factors. Manual fire fighting effectiveness is directly affected by how long (time) it takes for plant operations to accept or acknowledge the fire alarm and confirm that there is a fire. Once, plant operations has made the decision to respond the fire brigade (5 -10 minutes), the fire brigade has to react and then report to the fire brigade equipment locker(s) (5 -10 minutes) and don protective clothing, SCBA, and prepare the appropriate special fire fighting equipment to take with them to the fire area, zone or room under consideration (7 -15 minutes). Upon completing the donning of the appropriate protective equipment and selecting the initial fire fighting equipment to responded with, the brigade responds to the area of concern (5 -15 minutes before the complete team is assembled near the area of concern). Once in the area, the fire brigade deploys and readies its equipment to fight the fire (5 -15 minutes). Once the equipment is setup, the brigade then make its an effort to control and suppress the fire (7-30 minutes under ideal condtions). Once the fire has been placed under control complete fire extinguishment can be accomplished (30 minutes - 3 hours). Therefore, it is assumed that it takes from 34 minutes to 1 hour and 35 minutes for a fire brigade to control a challenging fire under ideal conditions. Time is a factor for fire growth and smoke development. For example, depending on the room size and the fuel burning, a dense layer of smoke (from floor to ceiling) can develop within a fire area, zone, and room under consideration in 5 to 15 minutes after fire initiation at a ventilation flow rate of 10 room air changes per hour.

Time is an important factor that needs to be considered. In addition to time, judgements will have to be made with regard to the skill of the fire brigade under strenuous conditions. Their ability to cope with the stress of a serious fire challenge and implement the guidance provided by the fire fighting (pre-fire plan) strategy are an equally important factors. These integrated factors (time, skill / equipment utilization) are best evaluated by witnessing a unannounced fire brigade drill.

Evaluate against code of

Pre-decisiona

General Evaluation Guidance

~~a. Communications~~

~~Evaluate the adequacy of the fire brigade communications equipment.~~

- ~~Individual radios with lapel microphones through a repeater (best)~~
- ~~Cell phones, regular phones, and message runners (minimal)~~

~~b. Fire Brigade Equipment~~

~~Evaluate the adequacy of the fire brigade equipment.~~

- ~~Appropriate specialized fire fighting nozzles, hose, and fittings provided.~~
- ~~Are the site wide fire hazards identified and the appropriate fire fighting and specialized extinguishing agents provided in the vicinity of the subject fire hazards.~~
- ~~Smoke removal equipment provided.~~
- ~~Specialized equipment, such a thermography equipment provided.~~
- ~~Appropriate search and rescue equipment provided.~~
- ~~Adequate SCBA and spare air cylinders.~~
- ~~Personal Protective equipment (turnout coats, pants, and helmet) meet industry and OSHA standards~~
- ~~Standpipe installed hose capable of reaching all areas~~

~~c. Fire Fighting (pre-fire plans) Strategies~~

~~Evaluate the fire brigade fire fighting (pre-fire plans) strategies. These fire fighting strategies should as a minium address the following for each fire area containing safety-related equipment or components:~~

- ~~Fire hazards~~
- ~~Extinguishants~~
- ~~Direction of attack~~
- ~~Systems to be managed to reduce loss~~
- ~~Heat sensitive systems~~
- ~~Fire brigade specific duties~~

- ~~Potential hazards toxic radiation~~
- ~~Smoke control management/Ventilation systems~~
- ~~Special operational instructions~~
- ~~Instructions for general plant~~

~~The fire fighting (pre-fire plans) strategies should included a smoke removal/venting plan. Assess how this plan will protect the redundant shutdown path to a harsh smoke environment as result of the plans implementation and that the plan takes into consideration on how the areas immediately adjacent to the fire area, zone, or room under consideration will be maintained tenable.~~

~~d. Fire Drill~~

~~Witness a unannounced fire brigade drill and evaluate the following:~~

- ~~Verify that the fire brigade response is satisfactorily demonstrated, including fire brigade leader command and control, teamwork, communications techniques, utilization of support from other resource groups, and proper selection of suppressant. Review the adequacy of the fire brigade's capability to locally control HVAC systems/dampers in the fire area. Review the licensee planning for post-fire habitability of important operating spaces (ventilation, room cooling).~~

- ~~The drill should comprehensive and simulate the use of fire fighting equipment required to cope with the type of fire and challenging environmental conditions presented by the fire and the burning materials under consideration. Observe the following:~~

  - ~~Protective clothing properly utilized.~~
  - ~~SCBA properly utilized. (Including wearing face pieces and using breathing air)~~
  - ~~Hose lines properly deployed.~~
  - ~~Entry into the fire room done properly.~~
  - ~~Assess fire brigade leader's direction, thoroughness, accuracy and effectiveness during the fire fighting effort.~~
  - ~~Radio communications with control room adequate?~~
  - ~~Did fire brigade check for propagation into another area?~~
  - ~~Did fire brigade utilize the fire fighting (pre-fire plans) strategies?~~
  - ~~Did the fire brigade perform smoke removal operations?~~
  - ~~Did the fire brigade bring sufficient equipment to the scene to properly perform fire fighting operations?~~
  - ~~Established back-up hose lines?~~

  ~~Note - The time of the alarm, the time the fire brigade is fully assembled, and the time the fire is placed under control.~~

- ~~Verify that drills make effective use of the pre-fire plans, and that the pre-fire plans accurately depict the conditions in the identified risk critical fire areas.~~

- ~~Determine whether communications between the control room and fire brigade are adequate to both fight the fire and conduct post-fire safe shutdown.~~

High Degradation Categories

The following are examples of high degradation categories:

(a) ~~Drill was observed and the fire scenario was not comprehensive~~ Should be based on performance, not scenario "quality"

(b) Drill was observed and demonstrated weaknesses[12] in the following areas:

[12] Note - Weaknesses in the fire brigade skill levels (i.e., team work, equipment deployment and utilization, and techniques) are the critical elements of this effectiveness evaluation and should be considered to be critical indicators of reactive performance.

Excessive fire brigade response

High degradation is three or more of the findings noted below. Each instance of a single brigade member counts as a finding. As an example, if three members of the brigade did not use proper techniques, that would be a high degradation.

- Consistently
- Fire brigade did not perform satisfactory as a team;
- Weaknesses associated with the proper use of personal protective equipment and fire fighting equipment and its deployment;
- Fire brigade did not use proper fire fighting techniques or agents to fight the simulated fire;
- Fire brigade did not use full protective equipment including SCBA ;
- Pre-fire plans and their goals were not fully implemented;
  Communications ~~was not satisfactory~~ineffective

(c) The fire brigade misses a drill.

Medium Degradation Categories

(a) A medium degradation occurs if there are two of the findings noted above.

~~The following are examples of medium degradation categories:~~

~~(a) If a drill can not be witnessed then assume that the fire brigade skill level and their response to a challenging fire condition would result in medium or average performance.~~

~~(b) Fire fighting (pre-fire plans) are less than comprehensive and do not establish the minimum guidance needed to support the necessary fire fighting operations.~~

~~(c) Fire brigade equipment not state-of-the-art, specialized fire fighting agents not provided for special hazards or adequately stagged, response and transport schemes for fire fighting equipment not well defined, and noted weaknesses in the material condition of fire brigade equipment.~~

(b) Fire brigade equipment not in good overall condition, specialized fire-fighting agents are not provided for special hazards or properly staged.

Low Degradation Categories

A low degradation occurs if there is one of the findings noted above.

The remaining examples constitute full compliance; hence there is no degradation.

~~The following are examples of low degradation categories:~~

~~(a) Drill scenario was well planned and the observed fire brigade performance was satisfactory when evaluated against the guidance above.~~

~~(b) No apparent weakness in fire brigade equipment or the stagging of this equipment, specialized fire extinguishing agents for special hazards are maintained in the appropriate areas of concern.~~

~~(c) Fire fighting (pre-fire plans) strategies are comprehensive and exceed minimum NRC guidance.~~

~~**9.0 Safe Shutdown Capability**~~

This section is not required because safe shutdown considerations are not treated separately in the “FMF” equation in the SDP. These considerations have been incorporated into other factors in the equation.

~~Degradation to post-fire safe shutdown capability are generally caused by direct fire damage to systems or components being used to achieve and maintain post-fire safe shutdown conditions, unsuitable environment for operator actions, safe shutdown equipment unable to provide injection at flow/pressure necessary to meet function and the unavailability of safe shutdown equipment due to fire induced circuit failures.~~

~~***General Assumption***~~

~~It is assumed that there are no other equipment failures except those identified below. If the reliability factors for the post-fire safe shutdown/recovery systems or components being taken credit for by this methodology are not satisfactory the risk significance of the fire area may need to be adjusted in a more detailed analysis.~~

~~***Extra High Degradation***~~

~~Redundant SSD trains are located in the area(s), zone(s), or room(s) under consideration. No recovery capability exists for performing essential functions external to the area, sone, or room under consideration.~~

~~***High Degradation***~~

~~Redundant SSD trains are located in the area(s), zone(s), or room(s) under consideration. Manual recovery of one fire affected SSD train is credited (e.g. alternative shutdown method for the control room) for providing the essential safe shutdown function(s).~~

~~***Medium Degradation***~~

~~Redundant SSD trains are located in the area(s), zone(s), or room(s) under consideration. One protected train or a recovery train available remains unaffected by the fire and immediately available.~~

~~***Low Degradation***~~

~~Redundant SSD trains are located in the area(s), zone(s), or room(s) under consideration. One protected train and the manual recovery of the fire affected SSD train or one system with redundancy (remaining trains subject to common cause failure (CCF)) remains unaffected by the fire and immediately available.~~

~~*Note that all degradations in safe shutdown of lesser severity than "Low Degradation" have minimal risk significance. As a result, safe shutdown capability with a minimum of two independent trains, each of which can perform the essential function, is minimally risk significant.*~~

Fire Protection Risk Significance Screening Methodology Lookup Tables

Table 4.1 Quantification of Degrad

Level of Degradation	Low	Medium	High	Extra High	
Shutdown Safe		-3	-2	-1	0
3-Hour Fire Barrier	-2 (door)		-1	0	N/A
1-Hour Fire Barrier		-1	-0.5	0	N/A
Automatic Fire Suppression Effectiveness		-1.5	-0.75	0	N/A
Manual Fire Fighting Effectiveness (Fire Brigade) – Outside Control Room	-1	-0.5	-0.25	N/A	
Manual Fire Fighting Effectiveness (Fire Brigade) – Inside Control Room		-1.5	-1	-0.5	N/A

Table 4.2, Fire Protection Defense-in-Depth Degradation Qualitative Rating (DQR) Character

Redundant SSD trains are located in the area(s), zone(s), or room(s) under consideration. No recovery capabili performing essential functions external to the area, sone, or room under consideration. **(EXTRA-HIG**

3-Hour Fire Barrier Protection Sch

Degradation Quality Ratings

Detection and manual fire suppression	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH
Fire barrier	LOW	LOW	LOW	MEDIUM	MEDIUM	MEDIUM	HIGH	HIGH	HIGH
Overall DQR for Area	LOW	MEDIUM	MEDIUM	MEDIUM	HIGH	HIGH	EXTRA-HIGH	EXTRA-HIGH	EXTRA-HIGH

1-hour Fire Barrier Protection Sch

Degradation Quality Ratings

Detection and automatic fire suppression	MEDIUM	HIGH	HIGH	HIGH	LOW	LOW	LOW	MEDIUM	MEDIUM	MEDIUM	HIGH	HIGH	HIGH	LOW	LOW	LOW	MEDIUM	MEDIUM	MEDIUM	HIGH	HIGH	HIGH
Detection and manual fire suppression	HIGH	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH
Fire barrier	LOW	LOW	LOW	LOW	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH
[illegible]	HIGH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	EXTRA-HIGH

Pre-decisional

Table 4.2, Fire Protection Defense-in-Depth Degradation Qualitative Rating (DQR) Chara

(HCA) Redundant SSD trains located within the same fire area(s), zone(s), or room(s)

3-Hour Fire Barrier Protection Scheme

Degradation Quality Ratings

Detection and manual fire suppression	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH
Fire barrier	LOW	LOW	LOW	MEDIUM	MEDIUM	MEDIUM	HIGH	HIGH	HIGH
Overall DQR for Area	MINIMAL	LOW	LOW	LOW	MEDIUM	MEDIUM	MEDIUM	HIGH	HIGH

1-hour Fire Barrier Protection Scheme

Degradation Quality Ratings

Detection and automatic fire suppression	HIGH	HIGH	LOW	LOW	LOW	MEDIUM	MEDIUM	MEDIUM	HIGH	HIGH	HIGH
Detection and manual fire suppression	MEDIUM	HIGH	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH
Fire barrier	MEDIUM	MEDIUM	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH

Table 4.2, Fire Protection Defense-in-Depth Degradation Qualitative Rating (DQR) Character

LOW	LOW	LOW	MEDIUM	MEDIUM
LOW	MEDIUM	HIGH	LOW	MEDIUM
LOW	LOW	LOW	LOW	LOW

44

Table 4.2, Fire Protection Defense-in-Depth Degradation Qualitative Rating (DQR) Chara

	HIG	LOW	MEDIUM

Table 4.2, Fire Protection Defense-in-Depth Degradation Qualitative Rating (DQR) Characte

Redundant SSD trains are located in the area(s), zone(s), or room(s) under consideration. One protected train or a re

available remains unaffected by the fire and immediately available.

(MEDIUM)

3-Hour Fire Barrier Protection Scheme

Degradation Quality Ratings

Detection and manual fire suppression

Fire barrier

Overall DQR for Area

Detection and automatic fire suppression

LOWLOWLOWMEDIUMMEDIUMMEDIUMHIGHHIGHHIGHLOWLOWLOWMEDIUMMEDIUMMEDIUMMEDIUM

1-hour Fire Barrier Protection Scheme

Degradation Quality Ratings

Detection and manual fire suppression

LOWMEDIUMHIGHLOWMEDIUMHIGHLOWMEDIUMHIGHLOWMEDIUMHIGHLOWMEDIUMHIGH

Fire barrier

LOWLOWLOWLOWLOWLOWLOWLOWLOWMEDIUMMEDIUMMEDIUMMEDIUMMEDIUMMEDIUMMEDIUM

Table 4.2, Fire Protection Defense-in-Depth Degradation Qualitative Rating (DQR) Chara

Table 4.2, Fire Protection Defense-in-Depth Degradation Qualitative Rating (DQR) Characte						
HIGH	HIGH	MEDIUM		HIGH	HIGH	HIGH
MEDIUM	HIGH	MEDIUM		HIGH	MEDIUM	HIGH
LOW	HIGH	LOW		HIGH	LOW	HIGH
HIGH	MEDIUM	LOW		MEDIUM	HIGH	HIGH
MEDIUM	MEDIUM	LOW		MEDIUM	MEDIUM	HIGH
LOW	MEDIUM	MINIMAL		MEDIUM	LOW	HIGH
HIGH	LOW	MINIMAL		LOW	HIGH	HIGH
MEDIUM	LOW	MINIMAL		LOW	MEDIUM	HIGH
LOW	LOW	MINIMAL		LOW	LOW	HIGH
				HIGH	HIGH	MEDIUM
				HIGH	MEDIUM	MEDIUM
				HIGH	LOW	MEDIUM
				MEDIUM	HIGH	MEDIUM
				MEDIUM	MEDIUM	MEDIUM
				MEDIUM	LOW	MEDIUM
				LOW	HIGH	MEDIUM
				LOW	MEDIUM	MEDIUM
				LOW	LOW	MEDIUM
				HIGH	HIGH	LOW
				HIGH	MEDIUM	LOW
				HIGH	LOW	LOW
				MEDIUM	HIGH	LOW
				MEDIUM	MEDIUM	LOW
				MEDIUM	LOW	LOW
				LOW	HIGH	LOW
				LOW	MEDIUM	LOW
				LOW	LOW	LOW

Pre-decisional

Table 4.2, Fire Protection Defense-in-Depth Degradation Qualitative Rating (DQR) Characte

3-hour Fire Barrier Protection Scheme

Redundant SSD trains are lo

recovery of the fire affected SS

remains unaffected by the fire and

Degradation Quality Ratings

Detection and manual fire suppression	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH
Fire barrier	LOW	LOW	LOW	MEDIUM	MEDIUM	MEDIUM	HIGH	HIGH	HIGH
Overall DQR for Area	MINIMAL	MINIMAL	MINIMAL	MINIMAL	MINIMAL	MINIMAL	MINIMAL	LOW	LOW

1-hour Fire Barrier Protection Scheme

Degradation Quality Ratings

Detection and automatic fire suppression	HIGH	HIGH	HIGH	LOW	LOW	LOW	MEDIUM	MEDIUM	MEDIUM	HIGH	HIGH	HIGH	LOW	LOW	LOW	MEDIUM	MEDIUM	MEDIUM	HIGH	HIGH	HIGH
Detection and manual fire suppression	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH
Fire barrier	LOW	LOW	LOW	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH

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Table 4.2, Fire Protection Defense-in-Depth Degradation Qualitative Rating (DQR) Characte

	LOWLOWLOWMEDIUMMEDIUMMEDIUM	LOWMEDIUMHIGHLOWMEDIUMHIGH	LOWLOWLOWLOWLOWLOW

Pre-decisional

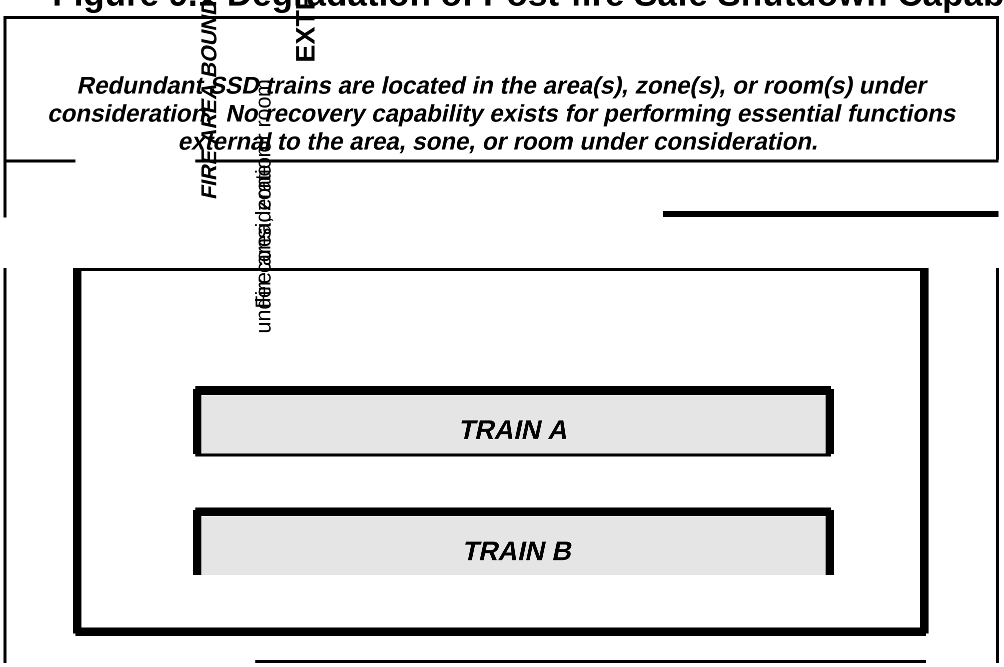
Table 4.3 Overall Fire Protection DID Degradation DQR Characterization for the Fire Area, Zone, or Room being Evaluated	
EXTRA HIGH	[illegible]
High	[illegible]
Medium	[illegible]
Low	[illegible]
Minimal	The [illegible]

Table 4.4a - Generic Ignition Frequencies Plant Buildings or Rooms	
Building or Room	***Ignition Frequency (IF)***
Containment	9E-3
Turbine Building	6E-2
Auxiliary Building	6E-2
Reactor Building	3E-2
Battery Room	3E-3 to 1E-2
Switchgear Room	1E-2
Diesel Generator Building	6E-2
Cable Spreading Room	5E-3
Control Room	7E-3

Table 4.4. Combination of Fire Ignition (Initiation) Frequency and Overall Fire Protection Defense-in-Depth (DID) Qualitative Rating (DQR) Characterization for a Fire Area(s), Zone(s) or Room(s) under Consideration

Fire Ignition (initiation) Frequency (IF)	Overall Fire Protection DID Degradation DQR Characterization for a Fire Area, Zone or Room unde[r] … Adjusted for Time Degraded Condition Existed											
	EXTRA HIGH			HIGH			MEDIUM			LOW		
	>30 days	30-3 days	<3 days	> 30 days	30-3 days	<3 days	> 30 days	30-3 days	<3 days	> 30 days	30-3 days	<3 days
IF > 10^{-3}	RED	RED	YELLOW	RED	YELLOW	WHITE	YELLOW	WHITE	WHITE	WHITE	GREEN	GREEN
$10^{-3} \geq$ IF > 10^{-4}	RED	YELLOW	WHITE	YELLOW	WHITE	GREEN	WHITE	GREEN	GREEN	GREEN	GREEN	GREEN
$10^{-4} \geq$ IF > 10^{-5}	YELLOW	WHITE	GREEN	WHITE	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
$10^{-5} \geq$ IF > 10^{-6}	WHITE	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN
IF $\leq 10^{-6}$	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN	GREEN

Figure 9.1 Degradation of Post-fire Safe Shutdown Capability



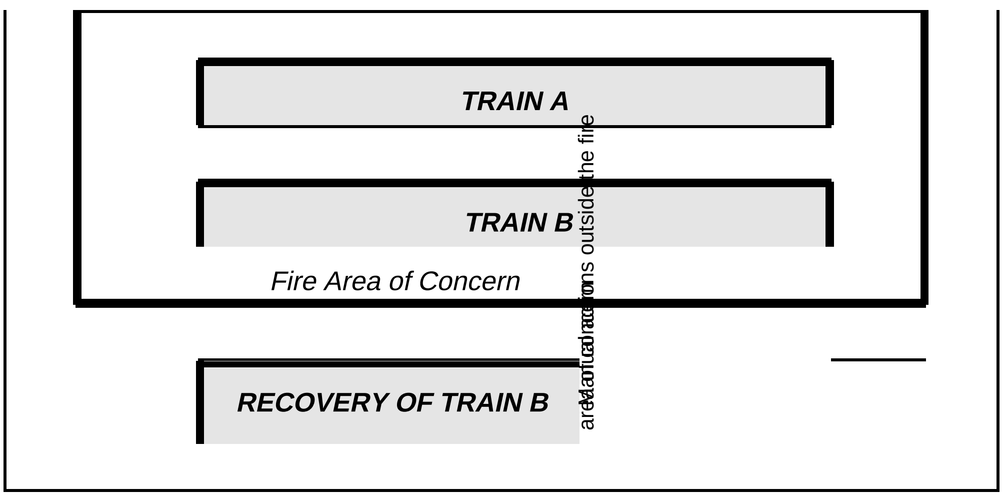
Pre-decisional

HIGH DEGRADATION

Figure 9.1a

Redundant SSD trains are located in the area(s), zone(s), or room(s) under consideration. Manual recovery of one fire affected SSD train is credited (e.g. alternative shutdown method for the control room) for providing the essential safe shutdown function(s).

FIRE AREA BOUNDARY

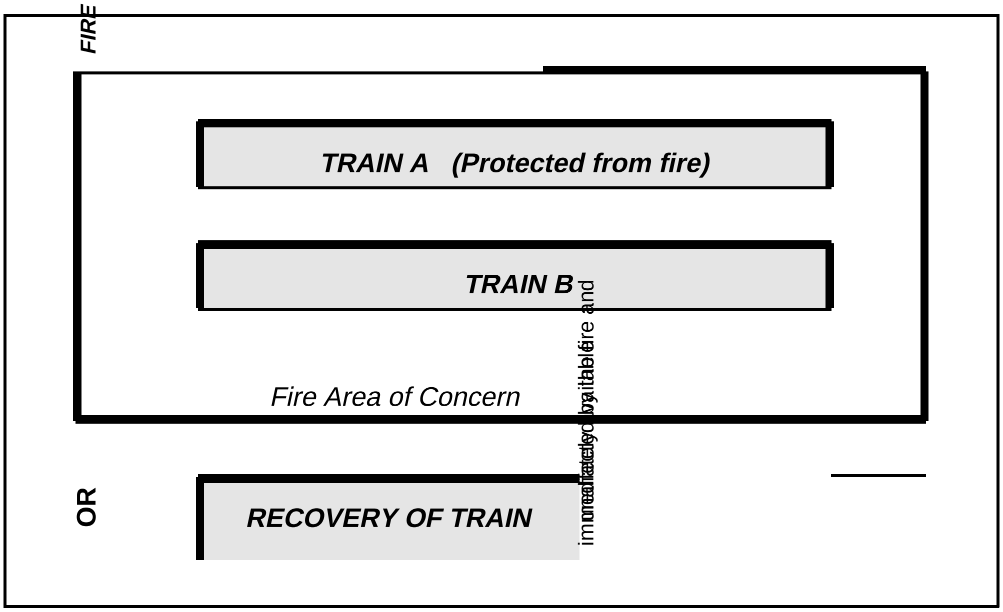


MEDIUM DEGRADATION

Figure 9.1b

Redundant SSD trains are located in the area(s), zone(s), or room(s) under consideration. One protected train or a recovery train available remains unaffected by the fire and immediately available.

Pre-decisional

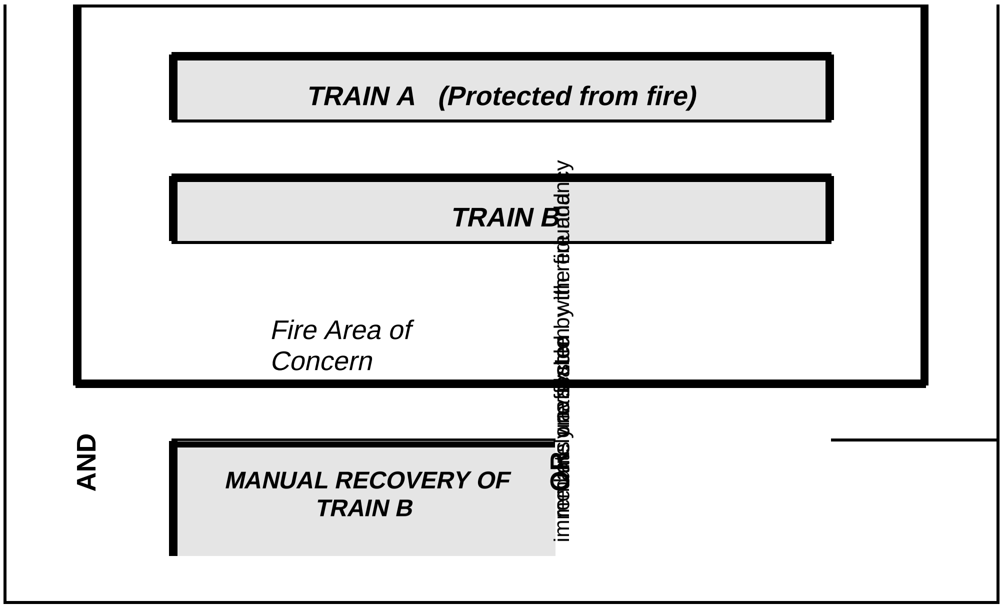


LOW DEGRADATION

Figure 9.1c

Redundant SSD trains are located in the area(s), zone(s), or room(s) under consideration. One protected train and the manual recovery of the fire affected SSD train or one system with redundancy (remaining trains subject to common cause failure (CCF)) remains unaffected by the fire and immediately available.

Pre-decisiona

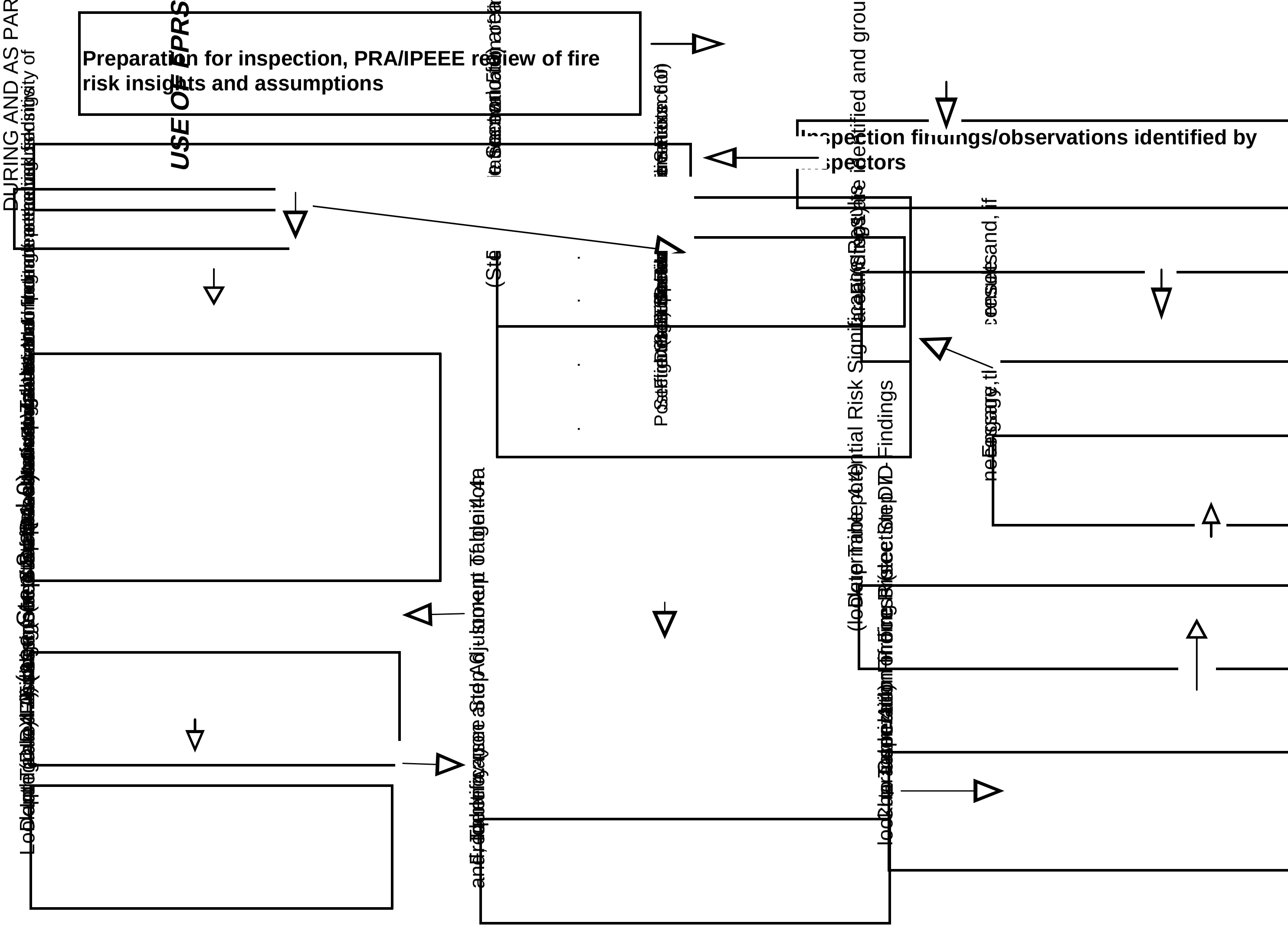


Pre-decisional

USE OF FPRSSM PROCESS

DURING AND AS PART OF THE INSPECTION

Figure 4.1- Fire Protection Risk Significance Screening Methodology (FPRSSM) Determination Process of Potential Risk Significance of Fire Protection Inspection Findings



Attachment 1

Application
Fire Protection Risk Significant Screening Methodology
to
Case Studies

Pre-decisiona

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is [illegible]

Pre-decisiona

PRS = IF + FB + SSD + AD/AS +D/MS

Pre-decisiona

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[illegible]

PRS [illegible] PRS [illegible]

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Pre-decisional

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Pre-decisiona

Remember that for medium degradation of fire barrier, the double room term is

adequate for this screening approach since the single room term is no larger than the double room term.

__Pre-decisiona__

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C. Con [illegible]

Pre-decisiona

64

[illegible]

PRS = IF + FB + SSD + AD/

Pre-decisiona

65

of 10.

13 Each of these values i

Pre-decision

66

__Pre-decisiona__

SDP Scenarios

2-14-00

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Scenario 2

to the safe shutdown system in question. The three-hour
without compensatory measures. The inspector notes
power to redundant safe shutdown trai

findings against DID elements are noted, except that 10% of the sprinklers do not meet spacing

Step 3: A high degradation is assigned for the fire barrier using IP XXX Appendix H. No other
Step 1: The inspector noted
The finding is not screened out in Phase 1. Step 1 s
Step 2: The fire scenario involves a fire in leaking fuel oil in either diesel generator r

resident determines that the door has bee

not independent. A Phase 2 analysis is warranted.

Pre-decisiona

rooms in question.
requirements.

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Scenario 3

except by barriers which are highly degraded) (Column (7)), this set of conditions is YELLOW.

	F = FM
1.5 -	IF
0	FB C>
-1	D
-2	S M
1.25 -	AS
+.5	AC
0	C C

Using NEI Formula ... Using NRC formula:

No degradation since no problems

F= FM	m: S		F = FM
2.95 -		1.2 -	IF
		0	FB
		-1	S M
		.75 -	AS
		0	D Q
		0	C C

Pre-decisional

Steps 4-7:

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Requirements ... in the room

Backup ... Station ... FM = 5.25 ... Taking the 'G'

FM

Sum:

5.25

-

Pre-decisiona

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Assumptions: Using NRC formula: Steps 4-7: Step 3. Qualitative assessment

common water system

No dependencies...

Detectable degradation is low

Operating rating is high

FMF =	Sum:		FMF =
-3.5		-2	IF
		0	FB
		-1.5	MS
		0	AS
		0	QD
		0	CC

Pre-decisional

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Scenario 5

[illegible]

common water system

[illegible]

	Sum:		
-4.3		-2.3	IF
		0	C>FB
		-.5	D
		-2	MS
		0	AS
		+.5	AC
		0	CC

Pre-decisiona

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If FMF = -4.00, this results in an ‘E’ from table 5.7 (>30 days)

Assumptions:

NRC’s having ‘not witnessed’ a fire brigade drill)

due to minimum rating.

Using NRC formula:

Fire Area Conditions (C

FMF =	Sum:		FMF =
-4.00		-3	IF
		0	FB
		-.25	MS
		-1.25	AS
		+.5	QD
		__	CC

Pre-decisional

---------------------------- Fire Area

FMF =			FMF =
	Sum:		
-7.0		-3	IF
		0	C>FB
		-1	D
		0	MS
		-4	AS
		+.5	AC
		+.5	CC

Pre-decisional

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Scenario 7

'indeterminate'

75

FMF =	Sum:	FMF =	
-10.5		-3	IF
		0	C>FB
		-1	D
		-2	MS
		-4	AS
		-.5	AC
		__	CC

FMF =	Sum:	FMF =	
-5.25		-3	IF
		0	FB
		-1	MS
		-1.25	AS
		__	QD
		__	CC

Pre-decisional

Assumptions: Using NRC formula: Steps 4-7. Step 3. Qualitative

IF = auxiliary building

Detection degradation is low Barrier degradation is medium

FMF	Sum:		FMF =
-2.45		-1.2	IF
		-0.5	FB
		-1	MS
		0	AS
			QD
		+.25	CC

Pre-decisional

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affects manual suppression

Pre-decisiona

	Sum:		
-3.95		-1.7	IF
		-.5	C>FB
		-.5	D
		-1	MS
		0	AS
		-.5	AC
		+.25	CC

77

as

<u>Pre-decisiona</u>

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