UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TEXAS 76011-4005

OCT 29 2002

Craig G. Anderson, Vice President,
Operations
Arkansas Nuclear One
Entergy Operations, Inc.
1448 S.R. 333
Russellville, Arkansas 72801-0967

SUBJECT: ARKANSAS NUCLEAR ONE - MEETING SUMMARY - DISCUSSION OF BACKFIT CLAIM REGARDING USE OF MANUAL ACTIONS TO MEET FIRE PROTECTION REQUIREMENTS

Dear Mr. Anderson:

This refers to the meeting conducted at the Hampton Inn in Russellville, Arkansas, on October 2, 2002. At this meeting we discussed your backfit claim regarding the use of manual actions to meet fire protection requirements. Our inspection, your backfit claim, and the results of our backfit panel are described in the following documents that are available in the Publicly Available Records (PARS) component of NRC's document system (ADAMS):

1. Arkansas Nuclear One, Units 1 and 2 - NRC Inspection Report 50-313/01-06; 50-368/01-06 dated August 20, 2001 (Accession Number: ML012330501)

2. Arkansas Nuclear One, Units 1 and 2 - Response to NRC Inspection Report 50-313/01-06; 50-368/01-06 Triennial Fire Protection dated September 28, 2001 (Accession Number: ML012710489)

3. Response to Backfit Claim Regarding NRC Inspection Report 50-313/01-06; 50-368/01-06 dated April 15, 2002 (Accession Number: ML021090419)

An attendance list and a copy of the references that you highlighted during the meeting are attached.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be made available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Should you have any questions concerning this matter, we will be pleased to discuss them with you.

Sincerely,

J. Clark for

Linda Joy Smith, Chief
Project Branch D
Division of Reactor Projects

Dockets: 50-313
50-368
Licenses: DPR-51
NPF-6

Enclosures:
1. Attendance List
2. Licensee Presentation

cc w/enclosures:
Executive Vice President
& Chief Operating Officer
Entergy Operations, Inc.
P.O. Box 31995
Jackson, Mississippi 39286-1995

Vice President
Operations Support
Entergy Operations, Inc.
P.O. Box 31995
Jackson, Mississippi 39286-1995

Manager, Washington Nuclear Operations
ABB Combustion Engineering Nuclear
Power
12300 Twinbrook Parkway, Suite 330
Rockville, Maryland 20852

County Judge of Pope County
Pope County Courthouse
100 West Main Street
Russellville, Arkansas 72801

Winston & Strawn
1400 L Street, N.W.
Washington, DC 20005-3502

Bernard Bevill
Radiation Control Team Leader
Division of Radiation Control and
Emergency Management
Arkansas Department of Health
4815 West Markham Street, Mail Slot 30
Little Rock, Arkansas 72205-3867

Mike Schoppman
Framatome ANP, Inc.
Suite 705
1911 North Fort Myer Drive
Rosslyn, Virginia 22209

NRC PUBLIC MEETING ATTENDANCE

LICENSEE/FACILITY	Entergy Operations, Inc. Arkansas Nuclear One
DATE/TIME	October 2, 2002; 8:00 a.m. to noon
LOCATION	Conference Room - Russellville Hampton Inn

NAME (PLEASE PRINT)	ORGANIZATION
WOODY WALKER	ENTERGY NUCLEAR - SOUTH
FRED EMERSON	NEI
Dale James	Entergy - ANO
Mike Krupa	ENTERGY - CORP
Glenn Ashley	Entergy - ANO
Mike Cooper	Entergy - ANO

NRC PUBLIC MEETING ATTENDANCE

LICENSEE/FACILITY	Entergy Operations, Inc. Arkansas Nuclear One
DATE/TIME	October 2, 2002; 8:00 a.m. to noon
LOCATION	Conference Room - Russellville Hampton Inn

NAME (PLEASE PRINT)	**ORGANIZATION**
Linda Joy Smith	USNRC
John N. Hannon	USNRC
Russ Bywater	USNRC
ELMO COLLINS	USNRC
REBECCA NEASE	USNRC
CHRIS Meyer	ADH
Joe Kowalewski	Entergy
Sherrie COTTON	Entergy
Craig Anderson	Entergy

NRC PUBLIC MEETING ATTENDANCE

LICENSEE/FACILITY	Entergy Operations, Inc. Arkansas Nuclear One
DATE/TIME	October 2, 2002; 8:00 a.m. to noon
LOCATION	Conference Room - Russellville Hampton Inn

NAME (PLEASE PRINT)	**ORGANIZATION**
Dan Williams	Entergy Operations, Inc.
Jessica Walker	Entergy Operations, Inc
Michael Bowling	Entergy Services Inc
Dan Fouts	Entergy Operations, Inc
Patricia Campbell	Winston & Strawn
Dee Hawkins	Entergy Ops
Sandy Siebenmorgen	Entergy Operations, Inc. / ANO

ENCLOSURE 2

ANO/NRC Appendix R Compliance Meeting
Agenda

1.	Opening remarks – NRC	
2.	Opening remarks – ANO	(Craig Anderson)
3.	History	(Glenn Ashley)
4.	Chronological Presentation of Relevant Appendix R Manual Action Manual Action Documents	(Woody Walker)
5.	Industry Survey Results	(Dale James)
6.	Backfit Discussion	(Glenn Ashley)
7.	Potential Resolution Paths	(Sherrie Cotton)
8.	Question/Answer	
9.	Final Remarks ANO	(Craig Anderson)
10.	Final Remarks NRC	

ANO Appendix R Implementation Timeline

	--	Pre-Appendix R
1980	--	10CFR50.48 and Appendix R issued
1981	--	GL 81-12 issued
1982	--	NUFPG formation
	--	Vollmer memo
	--	ANO compliance submittal
	--	NRC/ANO meeting on manual actions, etc.
	--	Additional submittal
	--	Revised Exemption requests
1983	--	NUFPG meeting with NRC
	--	SER issued for exemptions
	--	SECY 83-269
	--	GL 83-33
1984	--	Regional Workshops
	--	NRC/ANO meeting
	--	Reanalysis submittal
1987	--	Compliance audit performed by NRR
1988	--	SER issued for additional exemptions

U.S. NUCLEAR REGULATORY COMMISSION

April 2001

REGULATORY GUIDE

OFFICE OF NUCLEAR REGULATORY RESEARCH

REGULATORY GUIDE 1.189
(Draft was issued as DG-1097)

FIRE PROTECTION FOR OPERATING NUCLEAR POWER PLANTS

GLOSSARY

Alternative Shutdown — The capability to safely shut down the reactor in the event of a fire using existing systems that have been rerouted, relocated, or modified.

Approved — Tested and accepted for a specific purpose or application by a recognized testing laboratory.

Associated Circuits — Circuits that do not meet the separation requirements for safe shutdown systems and components and are associated with safe shutdown systems and components by common power supply, common enclosure, or the potential to cause spurious operations that could prevent or adversely affect the capability to safely shut down the reactor as a result of fire-induced failures (hot shorts, open circuits, and short to ground).

Automatic — Self-acting, operating by its own mechanism when actuated by some monitored parameter such as a change in current, pressure, temperature, or mechanical configuration.

Combustible Material — Any material that will burn or sustain the combustion process when ignited or otherwise exposed to fire conditions.

Common Enclosure — An enclosure (e.g., cable tray, conduit, junction box) that contains circuits required for the operation of safe shutdown components and circuits for non-safe shutdown components.

Common Power Supply — A power supply that feeds safe shutdown circuits and non-safe shutdown circuits.

Control Room Complex — The zone served by the control room emergency ventilation system.

Dedicated Shutdown — The ability to shut down the reactor and maintain shutdown conditions using structures, systems, or components dedicated to the purpose of accomplishing post-fire safe shutdown functions.

Emergency Control Station — Location outside the main control room where actions are taken by operations personnel to manipulate plant systems and controls to achieve safe shutdown of the reactor.

Exposure Fire — A fire in a given area that involves either in situ or transient combustibles and is external to any structures, systems, and components located in or adjacent to that same area. The effects of such fire (e.g., smoke, heat, or ignition) can adversely affect those structures, systems, and components important to safety. Thus, a fire involving one success path of safe shutdown equipment may constitute an exposure fire for the redundant success path located in the same area, and a fire involving combustibles other than either redundant success path may constitute an exposure fire to both redundant trains located in the same area.

Fire Suppression — Control and extinguishing of fires (firefighting). Manual fire suppression is the use of hoses, portable extinguishers, or manually actuated fixed systems by plant personnel. Automatic fire suppression is the use of automatically actuated fixed systems such as water, Halon, or carbon dioxide systems.

Fire Watch — Individuals responsible for providing additional (e.g., during hot work) or compensatory (e.g., for system impairments) coverage of plant activities or areas for the purposes of detecting fires or for identifying activities and conditions that present a potential fire hazard. The individuals should be trained in identifying conditions or activities that present potential fire hazards, as well as the use of fire extinguishers and the proper fire notification procedures.

Fire Zones — Subdivisions of fire areas.

Free of Fire Damage — The structure, system, or component under consideration is capable of performing its intended function during and after the postulated fire, as needed, without repair.

Hazardous Material — A substance that, upon release, has the potential of causing harm to people, property, or the environment.

High Impedance Fault — A circuit fault condition resulting in a short to ground, or conductor to conductor hot short, where residual resistance in the faulted connection maintains the fault current level below the component's circuit breaker long-term setpoint.

Hot Short — Individual conductors of the same or different cables come in contact with each other and may result in an impressed voltage or current on the circuit being analyzed.

Hot Work — Activities that involve the use of heat, sparks, or open flame such as cutting, welding, and grinding.

Impairment — The degradation of a fire protection system or feature that adversely affects the ability of the system or feature to perform its intended function.

Important to Safety — Nuclear power plant structures, systems, and components "important to safety" are those required to provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the public.

Interrupting Device — A breaker, fuse, or similar device installed in an electrical circuit to isolate the circuit (or a portion of the circuit) from the remainder of the system in the event of an overcurrent or fault downstream of the interrupting device.

In situ Combustibles — Combustible materials that constitute part of the construction, fabrication, or installation of plant structures, systems, and components and as such are fixed in place.

Isolation Device — A device in a circuit that prevents malfunctions in one section of a circuit from causing unacceptable influences in other sections of the circuit or other circuits.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

JUL 2 1982

MEMORANDUM FOR: Richard H. Vollmer, Director, Division of Engineering

FROM: Roger J. Mattson, Director, Division of Systems Integration

SUBJECT: POSITION STATEMENT ON ALLOWABLE REPAIRS FOR ALTERNATIVE SHUTDOWN AND ON THE APPENDIX R REQUIREMENT FOR TIME REQUIRED TO ACHIEVE COLD SHUTDOWN

Some licensees have experienced difficulties in interpreting two areas of Sections III.G and III.L. The purpose of this memorandum is to inform you of these two areas and interpretations which we believe are needed. These interpretations pertain to the (1) allowable repairs to achieve safe shutdown and (2) allowable time to achieve safe shutdown. The interpretations which follow are not new. We request your concurrence in this matter.

Allowable Repairs to Achieve Safe Shutdown

Section III.G.1 of Appendix R states that one train of systems needed for hot shutdown must be free of fire damage. Thus, one train of systems needed for hot shutdown must be operable during and following a fire. Operability of the hot shutdown systems, including the ability to overcome a fire or fire suppressant induced maloperation of hot shutdown equipment and the plant's power distribution system, must exist without repairs. Manual operation of valves, switches and circuit breakers is allowed to operate equipment and isolate systems and is not considered a repair. However, the removal of fuses for isolation is not permitted. All manual operations must be achievable prior to the fire or fire suppressant induced maloperations reaching an unrecoverable plant condition.

Modifications, e.g., wiring changes, are allowed to systems and/or components not used for hot shutdown, but whose fire or fire suppressant induced maloperations may indirectly affect hot shutdown. These repairs must be achievable prior to the maloperations causing an unrecoverable plant condition.

Repairs for cold shutdown systems are allowed by Section III.L.5 of Appendix R. For cold shutdown capability repairs, the removal of fuses for isolation and the replacement of cabling is permitted. Also, selected equipment replacement, e.g., such as replacing a valve, pump, control room controls and instruments, will be reviewed on a case-by-case basis to verify its practicality within the appropriate time constraints. Procedures for repairing damaged equipment should be prepared in advance with replacement equipment (i.e., cables

Contact: G. Harrison, DSI:ASB
X-27970

JUL 2 1982

made-up with terminal lugs attached) stored onsite. All repairs should be of sufficient quality to assure safe operation until the plant is restored to an operating condition. Repairs not permitted include the use of clip leads in control panels (which means that hard wired terminal lugs must be used), and the use of jumper cables other than those fastened with terminal lugs.

When repairs are necessary in the fire area, the licensee will have to demonstrate that sufficient time is available to allow the area to be re-entered and that expected fire and fire suppressant damage will not prevent the repair from taking place and that repair procedure will not endanger operating systems. In addition, written procedures must exist for the orderly transfer of control from the control room and the remote shutdown stations and vice versa. The repairs to cold shutdown systems are considered to be an upper limit. The licensee may design the plant so that cold shutdown can be achieved without repair.

Allowable Time to Achieve Safe Shutdown

Section III.G of Appendix R states that fire damage to cold shutdown capability must be limited to damage that can be repaired within 72 hours. Section III.L.1 of Appendix R states that the alternative shutdown capability shall be able to achieve cold shutdown within 72 hours. Further, Section III.L.5 of Appendix R states that fire damage shall be limited so that the systems can be made operable and cold shutdown achieved within 72 hours. Sections III.L.1 and III.L.5 state that a plant must be capable of achieving cold shutdown using only onsite power prior to the elapse of 72 hours. Section III.L.5 also clearly states that off-site power is assumed restored after 72 hours in that equipment and systems not needed until 72 hours may be powered by offsite power only.

We have been using and propose to continue to use Sections III.L.1 and III.L.5 in our evaluations. Thus, a licensee should have the capability of repairing equipment and achieving cold shutdown within 72 hours using only onsite power. The 72 hours is considered an upper limit; a licensee may limit the repairs and achieve cold shutdown in a shorter time frame.

We have applied the interpretations of Sections III.L.1 and III.L.5 of Appendix R to approximately twenty plant fire protection reviews. We propose to continue to use the interpretations discussed above for future alternative shutdown reviews. If you agree, then please indicate your concurrence at the bottom of this page and return to me.

Original Signed by:
Roger J. Mattson

Roger J. Mattson, Director
Division of Systems Integration

Approved: Original Signed By
Richard H. Vollmer, Director
Division of Engineering

ARKANSAS POWER & LIGHT COMPANY
POST OFFICE BOX 551 LITTLE ROCK, ARKANSAS 72203 (501) 371-4000

July 1, 1982

FILMED & ENTERED 2-7-83 TDR

0CAN078202

Mr. Darrell G. Eisenhut, Director
Division of Licensing
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

SUBJECT: Arkansas Nuclear One - Units 1 & 2
Docket No. 50-313 & 50-368
License No. DPR-51 & NPF-6
Results of Appendix R Compliance Review

Gentlemen:

As requested in your letter for ANO-1 (1CNA058202) and your letter for ANO-2 (2CNA058203) both dated May 10, 1982, the following is provided.

The ANO fire zones were reviewed for their compliance to 10CFR50.48 and 10CFR50 Appendix R. The review was structured to incorporate the recommendations, clarifications, and evaluation criteria of Generic Letter 81-12. Our submittal also considers the staff's positions and perspectives advanced in its discussions with the Nuclear Utility Fire Protection Group during the period of December 1981 to March 1982, and reflected in the Nuclear Utility Fire Protection Group's letter of March 16, 1982, to Richard H. Vollmer, Director, Division Engineering.

The attached report documents the results of this review and is formated as requested by the Generic Letter 81-12 clarifications. As requested, an item by item response is provided for each applicable information request. Where appropriate, exemptions from 10CFR50.48 and 10CFR50 Appendix R have been sought per 10CFR50.48.C.6.

This letter and the attached report provides AP&L's complete response as requested by your two May 10, 1982, letters and is submitted on July 1, 1982, as requested. Five (5) copies of our submittal will be hand delivered to our ANO-2 Project Manager on July 1, 1982, to aid in the staff's review.

- Zones That Will Satisfy Appendix R Following Modifications - these are zones that do not presently satisfy Appendix R, but will fully comply following modifications (Section 3.0 of Report).

- Zones Requiring Exemption - these are zones that do not presently comply, and where full compliance is not judged to be necessary to meet the intent of Appendix R. In most of these, modifications are proposed to improve fire protection for these zones, yet full compliance will not be achieved (Section 4.0 of Report).

Section 5.0 of this report, presents a request, and provides justification for, an exemption, in specific cases, from the schedule for implementation of modifications as set forth in 10CRF50.48(c).

The appendices to this report provide additional detail to clarify or expand on information contained in Sections 3.0 or 4.0, and to provide the information requested by the May 10, 1982, letters. Appendix F provides information useful in studying enclosed drawings.

The detailed evaluation performed by AP&L to compare ANO-1 and ANO-2 to the requirements of Appendix R contained several major tasks summarized as follows:

1. The original Fire Hazards Analysis was used as a basis for this review. Fire zones containing safe shutdown components and any redundancies thereof were identified.

2. A separate evaluation of associated circuits was used to identify circuits of concern.

3. Modifications made to the plants subsequent to issuance of the original FHA were reviewed and incorporated where applicable.

4. As the definition of fire zones in the original FHA did not require zone boundaries of 3-hour fire rating, adjacent zones as well as all zones within 20 feet of the zone in question were considered. Additional redundancies were identified by this comparison.

5. Additional redundancies identified in 4 above were evaluated for their effects on safe shutdown capabilities.

6. In certain cases, credit for manual operation of equipment was taken if controls (and power for valves) could possible be damaged by a fire. Such credit was taken only if:

   a. the component to be operated is not located in the affected fire zone, although the cable may be damaged by fire;

   b. sufficient time is available to perform the required manual actions; and

   c. personnel are available, beyond the fire brigade and minimum operations shift crew limitations, to perform the manual actions.

7. For redundancies that were still identified as potential safe shutdown concerns following the above review, specific physical separation, barriers, intervening combustibles, and suppression systems were evaluated to determine compliance with Section III.G of Appendix R.

8. For those redundancies remaining as a potential safe shutdown concern following 7 above, alternative means for accomplishing the necessary function was reviewed.

9. Required modifications were identified to bring zones into full compliance, or to a level of fire protection safety judged equivalent to alternatives of Appendix R.

10. Engineering design concepts for necessary alternate shutdown capability were developed.

11. Necessary Exemption requests were prepared.

12. Special consideration was given to the cold shutdown requirements of Appendix R and are described in Appendix E to this report.

The evaluations described above were performed in accordance with the criteria of appendix R, including: consideration of cable insulation as combustible; taking no credit for cable coatings to act as a thermal or radiant barrier to protect cables; and diverting primary reliance from administrative controls to preclude fires or damage due to fires.

SECTION 2

ZONES SATISFYING APPENDIX R

Of the 143 fire zones analyzed for ANO Units 1 and 2, 100 of them were determined to be in compliance with the requirements set forth in 10 CFR 50.48 and Appendix R to 10 CFR 50. The following is a listing, by unit, of each of those zones, by number and name, with a brief statement of the basis for compliance.

UNIT 1 (continued)

ZONE NUMBER	NAME	BASIS FOR COMPLIANCE
125E	Laundry Room (EL 386)	Contains no redundant safety equipment or cables nor associated circuit concerns.
14EE	West Decay Heat Removal Pump Room (EL 317)	Redundant safety systems in this zone not required for hot/cold shutdown.
144D	South Upper Electrical Penetration Room (EL 386)	Contains no redundant safety equipment or cables nor associated circuit concerns.
149E	North Upper Electrical (EL 386)	Manual operation may be required for both hot and cold shutdown.
157B	Chemical Addition Area (EL 404)	Contains no redundant safety equipment or cables nor associated circuit concerns.
159B	Spent Fuel Area (EL 404)	Contains no redundant safety equipment or cables nor associated circuit concerns.
16Y	Clean Waste Receiver Tank Area (EL 327)	Contains no redundant safety equipment or cables nor associated circuit concerns.
160B	Computer Room (EL 404)	Redundant safety systems in this zone not required for hot/cold shutdown.
161B	Ventilation Equipment Area (EL 404, 422)	Contains no redundant safety equipment or cables nor associated circuit concerns.
162A	Stair No. 1 (EL 404 to 317)	Contains no redundant safety equipment or cables nor associated circuit concerns.

SECTION 3

ZONES THAT WILL SATISFY APPENDIX R FOLLOWING MODIFICATIONS

The evaluation that was performed to determine the compliance of Arkansas Nuclear One, Units 1 and 2 with the requirements of 10 CFR 50 Appendix R identified several fire zones that did not fully comply with the requirements of Appendix R. For certain of these fire zones, exemptions are being requested as described in Section 4.0 of this report. For the remaining zones that do not presently comply with Appendix R, modifications can be made to bring the zones into compliance with the requirements of Appendix R. The following provides a brief description of modifications that will be made to those fire zones. Where alternate shutdown capability is being relied upon to bring the zone into compliance with 10 CFR 50 Appendix R, the modifications and plant features to provide this alternate shutdown capability are described in Appendices A & B.

APPENDIX A

ALTERNATE SHUTDOWN MEANS

A-1 General

As indicated in Section 3.0 of this report, an alternate shutdown capability is being provided to comply with Appendix R and to mitigate the consequences of a fire in any one of the following fire zones:

ANO-1	ANO-2
97-R, Cable Spreading Room	2098-L, Cable Spreading Room
129-F, Control Room	2199-G, Control Room
	2150-C, Core Protection Calculator Protection Panel Room
	2136-I, Controlled Access

The approach taken for the alternate shutdown means is to assume the fire causes the loss of function from the control room, with potential faults on cables that pass through these areas. Reliance is placed on local startup of a diesel generator and manual operation of breakers and local operation of valves. The capability of monitoring key plant parameters to accomplish safe shutdown will be provided by the Safety Parameters Display System (SPDS).

Systems

The following are the major components relied on to effect shutdown using the alternate shutdown means. Components listed are for ANO-2; ANO-1 components are discussed in parentheses if different from ANO-2.

APPENDIX B

DIESEL GENERATOR FUEL TRANSFER PUMP CROSS-FEEDS

For several zones in ANO-1 and ANO-2, the potential for loss of redundant diesel generator fuel oil transfer pumps due to a fire must be considered due to the proximity of cable routing. The zones affected are the following:

ANO-1	ANO-2
53Y	2081HH
1MH09	2096M
1MH10	2091BB
	2107N
	2223KK
	2106R
	2109U

To resolve this, a cross-tie capability will be provided between the ANO-1 and ANO-2 fuel oil transfer pumps, as shown in Figure A. A 2" hose will be used for making the cross-connection when transfer pumps must be used to supply the diesel generators of the opposite Unit.

Since this modification will in effect result in an alternate flowpath independent of the normal shutdown path using the Unit's associated diesel fuel transfer pumps, the following information is provided in response to the "Rewrite of Section 8 Request For Additional Information, Attachment 1" from the NRC letters of May 10, 1982 to AP&L. Since the information request is based on a complete alternate shutdown system, some of the items are not directly applicable to this particular modification.

A-1 GENERAL

a. Emergency diesels are required for hot/cold shutdown and as such a fuel supply is neccessary to continue their operation. This diesel fuel supply system is required and designed to remain operational following loss of offsite power.

b. There are two transfer pumps for each diesel generator unit: Unit 1 - P-16A & P-16B and Unit 2 - 2P-16A & 2P-16B. These pumps

W. CAVANAUGH
J. GRIFFIN
T. KILGORE
M. PENDERGRASS
[illegible]E
[illegible]SON
J. LEVINE
J. MARSH
ANO-DCC
D. RUETER (2)
J. MARSHALL
D. HOWARD-ANO-1
T. ENOS-ANO-2
R. ROTHWELL
H. CAWTHON
G. Vissing (NRC)
Shirley Bell

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D C 20555

August 25, 1982

CMNRCI

RECEIVED
1982
ARKANSAS POWER & LIGHT CO.
TECH. & ENV. SERVICES

REVIEWED BY [illegible] COMMITMENT YES NO

Nos. 50-313 & 368

MEMORANDUM FOR: John F. Stolz, Chief, Operating Reactors Branch #4, DL

FROM: Guy S. Vissing, Project Manager, Operating Reactors Branch #4

SUBJECT: FORTHCOMING MEETING WITH ARKANSAS POWER AND LIGHT COMPANY CONCERNING ALTERNATE SAFE SHUTDOWN MEANS FOR ANO-1 & 2 - APPENDIX R

Time & Date: August 31, 1982, Tuesday
10:00 a.m. - 4:00 p.m.

Location: Maryland National Bank Building, 6507
Bethesda, MD

Purpose: To discuss questions (Enclosure 1) concerning the alternate safe shutdown means for ANO-1 & 2

Requested Participants: NRC-Guy Vissing, Charles Trammell, Jan Stevens, Vince Panciera, Raj Goel

AP&L-Larry Parscale, Ted Enos

Other-John Taylor, BNL
H. George, TERA

Guy S. Vissing, Project Manager
Operating Reactors Branch #4
Division of Licensing

3pg. Enclosure:
1. Questions

cc w/enclosure:
See next page

CHRONOLOGICAL FILE

POST FIRE SAFE SHUTDOWN CAPABILITY

ARKANSAS NUCLEAR ONE - UNITS 1 and 2

BNL Questions/Information Requests on Licensee's 7/1/82 Submittal

1. The licensee should define the systems required to bring the plant to both hot and cold shutdown conditions. This includes all required mechanical and electrical support systems. The equipment, instrumentation and cable in each fire area should be tabulated.

2. For the fourteen fire zones that the licensee indicates are in full compliance with Appendix R, but require some sort of manual or non-routine operation, the licensee should describe the safe shutdown equipment and cables that would be effected by a fire and the specific operator actions that would be required to obviate these effects.

3. The licensee should present additional detail in regards to the operator actions that would be required to provide alternate shutdown independent of the control room and cable spreading rooms. Is the licensee going to prepare emergency procedures to implement these operator actions?

4. Will the loss of offsite power affect the capability of supplying diesel generator fuel oil, via the transfer pumps, to both units.

5. Performance goals of Section III.L

   a. Will the reactor trip system be used for shutdown?

   b. What is the source of boration and makeup water?

   c. Will the pressurizer heaters, or some means of pressure control, be used for shutdown? If so, please describe.

   d. Will indications be available for source range monitoring and any necessary tank levels?

   e. What are the ventilation and electrical distribution systems required for alternate shutdown.

   f. What are the systems required to achieve cold shutdown?

6. Can the units be brought to cold shutdown within 72 hours?

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. CAVAN UGH
. GRIFFIN
. KILGORE
. PENDERGRASS
. LANE
. WILSON
J. LEVINE
. [illegible]SH
[illegible]
. [illegible]ER (2)
. MARSHALL
P. HOWARD-ANO-1
. ENOS-ANO-2
R. ROTHWELL
H. CAWTHON
. Vissing (NRC)
Shirley Bell

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SEP 03 1982

RECEIVED
SEP 10 1982
ARKANSAS POWER & LIGHT CO.
Energy Supply

Docket No. 50-313

CLNROT
CFLIC

09820760

REVIEWED BY [illegible] COMMITMENT YES NO

SUBJECT: SUMMARY OF MEETING WITH ARKANSAS POWER AND LIGHT COMPANY (AP&L) ON AUGUST 31, 1982 CONCERNING THE ALTERNATE SAFE SHUTDOWN CAPABILITY IN THE EVENT OF A FIRE AT ARKANSAS NUCLEAR ONE, UNITS NOS. 1 & 2 (ANO-1 & 2)

Introduction

This meeting was held in Bethesda, Maryland on August 31, 1982 at the request of the NRC staff to discuss the subjects on the enclosed proposed list of information (Enclosure 1). The attendees of the meeting are identified in Enclosure 2.

Discussion

Highlights of the discussions concerning each item in Enclosure 2 follows in the order identified in Enclosure 2.

1. AP&L did not review the safe shutdown capability by a system approach. Their methodology included a review of each zone and the functions related to safe shutdown performed within the respective zones. They then investigated each component in the zone to determine the effect on the necessary function if that component was assumed to fail. If anything would fail the function, then methods were determined how to maintain the safe shutdown capability. The staff needs a written discussion of the AP&L methodology and some examples of its application.

2. AP&L provided a response in Enclosure 3. In addition to what was provided in Enclosure 3 the staff wanted to know how much time an operator has before there would be an unrecoverable situation. That staff also wanted to know if there would be enough people available to operate the plant in the event of a fire.

3. The staff wants a full description of all the operations required of the operators to bring the plant to hot and cold shutdown. The following summary of plant operations was provided:

a) The operator would assure that the reactor was tripped. If it was not tripped the operator would trip the RPS.
b) They would station one man at the steam driven emergency feed pump and valves and one man at the makeup pump.
c) These operators would then be instructed in the local operation of the EFW pump valves and makeup pump to bring the plant to hot and cold shutdown.

The licensee indicated that there would be 1 to 1 1/2 hours before there would be a need for makeup water.

David Lowe

10820262

ARKANSAS POWER & LIGHT COMPANY
POST OFFICE BOX 551 LITTLE ROCK, ARKANSAS 72203 (501) 371-4000

October 5, 1982

ØCAN1Ø82Ø3

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Washington, D. C. 20555

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Washington, D. C. 20555

SUBJECT: Arkansas Nuclear One - Units 1 & 2
Docket Nos. 50-313 & 50-368
License Nos. DPR-51 & NPF-6
Request for Additional Information
to Appendix R Compliance Submittal

Gentlemen:

Pursuant to our meeting of August 31, 1982, and your request dated September 3, 1982, (ØCNAØ982Ø1), we have been requested to furnish additional information concerning safe shutdown capability as addressed in our July 1, 1982, Appendix R compliance submittal (ØCANØ782Ø2). We have prepared the following response to each of 7 items for which a response was requested at that meeting.

Item 1:

Provide a summary of the methodology used in reviewing ANO-1 & 2 capabilities for hot shutdown and cold shutdown in the event of a fire; and provide some typical examples of the application of your methodology.

Response:

The detailed evaluation performed by AP&L to compare ANO-1 and ANO-2 to the requirements of Appendix R contained several major tasks which are summarized on pages 2 and 3 of Section 1 and Appendix E of our July 1, 1982, submittal. In clarification of that information, the following is provided.

The original Fire Hazards Analysis was used as a basis for the review. The evaluation method for this analysis was described in detail in our February 28, 1978, submittal, and was based on the concept of performing and maintaining three shutdown functions, i.e., reactivity control, primary inventory makeup, and primary heat removal. The individual zone documentation packages from that analysis consist of a description of the zone, a summary of the potential heat load to the zone resulting from complete combustion of combustibles (including an assumed 1×10^5 BTU of transient combustibles), a list of redundancies identified, a list of safety grade systems which have circuits or components in the zone, a description of the available fire protection, and a list of raceways in the zone. The raceway list includes a list of circuits in the raceway and data for heat load calculations for raceways with exposed cables (trays). Recognizing that some of these documentation packages might not contain the latest "as-built" information, we conducted a review of applicable plant design change packages (DCP). No modifications were necessary as a result.

With this "initial" data in hand and through use of the latest drawings (P&ID, HVAC, Cable/Raceway, Architectural, etc.) and, where possible, physical observation, each fire zone was reviewed against the Appendix R criteria for fire protection. The basic concept for review consisted of identifying functional redundancies of safe shutdown components located within the zone and determining if the plant could be safely shutdown without those components. If not, then an evaluation was performed to determine if: (1) Appendix R requirements were already met; or (2) some type modification, alternative shutdown, exemption request, etc., would be necessary for compliance. If plant shutdown could be safely accomplished without those components, and since the definition of fire zones in the original Fire Hazards Analysis did not require zone boundaries of 3-hour fire rating, adjacent zones as well as zones within 20 feet were considered with regards to their potential effect on redundancy to the zone in question for zone boundaries that had less than a 3-hour fire rating boundary.

The evaluations conducted within the methodology described above considered associated circuits. This aspect is addressed in detail in our response to question 5.

In certain cases, credit for manual operation of equipment was taken if controls (and power for valves) could possibly be damaged by a fire. Such credit was taken (and noted in Section 2 of our July 1 submittal) only if:

a. the component to be operated is not located in the affected fire zone, although the cable may be damaged by fire;

b. sufficient time is available to perform the required manual actions; and

c. personnel are available, beyond the fire brigade and minimum operations shift crew limitations, to perform the manual actions.

These are also discussed in greater detail in our response to question 2.

For redundancies that were still identified as potential safe shutdown concerns following the above review, specific physical separation, barriers, intervening combustibles, suppression systems, etc., were evaluated and required modifications or alternative means for accomplishing necessary functions were identified to bring zones into full compliance, or to a level of fire protection safety judged to be equivalent to alternatives of Appendix R.

The evaluations described above were performed in accordance with the criteria of Appendix R, including consideration of cable insulation as combustible, taking no credit for cable coatings to act as a thermal or radiant barrier to protect cables, and diverting primary reliance from administrative controls to preclude fires or damage due to fires.

Attached are documentation packages from one example fire zone from each unit that demonstrate the application of our methodology. These two zones include one which was found to meet Appendix R and one which was found to require an exemption. These packages are from the original fire hazards analysis and are only presented for example of the basis of our methodology. As stated earlier, a review was conducted on these packages to determine all modifications made to these zones subsequent to the Fire Hazard Analysis date. The following paragraph demonstrates the application of our methodology utilizing the example packages attached.

A comparison of the function which requires each red channel circuit with the function which requires each green channel circuit (pages 63.1 through 63.23 of attachment) resulted in the list of redundancies included in the package (pages I-59 through I-61 of attachment), and a subsequent review of the redundancies identified those involving safe shutdown functions (utilizing drawings and observation). In zone 149-E, the service water sluice gates were identified as redundant safe shutdown function equipment. It was also determined that these could be manually operated. As a result of our review of components for spurious actuation problems, the decay heat drop line valves were identified in zone 149-E. However, it was determined that the control logic for those valves prevented them from being spuriously opened by a fire in this zone. After completing the review process described above, we concluded this zone met Appendix R requirements. In zone 2040-JJ, the charging pumps, RWT discharge valves, and (for cold shutdown) the shutdown cooling water heat exchanger service water valves were identified. An exemption request was developed for the charging pumps (summary of and basis for exemption provided in section E on page 46 of 52 of our July 1 submittal), an alternate source of borated water was identified that was available if the RWT valves were lost, and the shutdown cooling water heat exchanger service water valves were determined to be manually operable for cold shutdown. The results of this analysis are presented in section 4 of our July 1 submittal.

<u>Item 2</u>:

For the 14 fire zones that you indicate are in full compliance with Appendix R, but require some sort of manual or non-routine operation, describe the safe shutdown equipment and cables that would be effected by a fire and the specific operator actions that would be required to obviate these effects. In your discussion of this issue discuss the times for required action that the operator has before the plant would get into an unrecoverable situation.

Response:

Zones 149E, 67U, 68P and 128E

Cables for all the Service Water Sluice Gates are in each of these zones. If hot shorts somehow selectively closed both gates which permit the pump suction bays to be supplied with lake water and left all 3 of the gates closed which permit the pump suction bays to be supplied with emergency cooling pond water, then one gate would have to be manually opened to maintain suction supply for a service water pump.

With loss of offsite power, the limiting function of service water in relation to promptness is emergency diesel generator cooling. As noted in Appendix A (A-2.1.f) of our July 1, 1982, submittal, the diesel is not required for at least 1½ hours, i.e., until primary system makeup is required.

Zone 170Z

The Atmospheric Dump Valves and Atmospheric Dump Block Valves are in this zone. They are required only for cold shutdown. To achieve cold shutdown, one of each in the same loop may have to be manually opened. Cold shutdown actions can be delayed without limit.

Zone 38Y

A cable for CV-1404 (Decay heat drop line from the Reactor Coolant System) is in this zone. To reach cold shutdown that valve may have to be manually opened. Cold shutdown actions can be delayed without limit.

Zones 79U and 112I

Cables for the "C" Makeup pump lube oil pump and the "B" Makeup pump cooler service water inlet valve are in each of these zones. If "A" Makeup pumps should be out of service (as permitted for unlimited time periods by the technical specifications) and a fire caused hot short causes the "B" Makeup cooler service water inlet valve to close, the "C" Makeup pump can be used for inventory makeup and/or heat removal by overriding the pump lube oil start interlock with a manual Emergency Safeguards initiation or the "B" Makeup pump can be used by manually opening the pump cooler service water inlet valve. Even so, we consider the probability of simultaneous occurrence of this Technical Specification condition and a fire in the same zone extremely small.

Cables for valves CV-1050, CV-1404 and CV-1428 are in each of the zones and Zone 79U has a cable for CV-1401 and Zone 112I has a cable for CV-1410. Valves CV-1050, CV-1410 and CV-1404 are in the Decay Heat drop line from the Reactor Coolant System and CV-1401 and CV-1428 are in the

Decay Heat cooler discharge line back to the Reactor Coolant System. To achieve cold shutdown CV-1050, CV-1404, CV-1401 and CV-1428 may have to be manually opened for a fire in Zone 79U and CV-1050, CV-1410, CV-1404 and CV-1428 may have to be manually opened for a fire in Zone 112I. Cold shutdown actions can be delayed without limit.

The makeup pumps can operate on the order of an hour before cooling water flow to the pump is essential. In addition, the requirement to use the makeup pumps does not exist until at least 1½ hours after a trip coincident with a loss of offsite power and then required use may be intermittent. If the reactor coolant system is tight (low leakage) the requirement may not exist for many hours. As a result, actions to restore cooling water flow or override pump lube oil start interlocks are not expected to be required at all but would certainly not be required for a least 3 or 4 hours.

Zones 46Y and 47Y

Cables for CV-1050 (Decay heat drop line from the Reactor Coolant System) are in these zones. To reach cold shutdown, that valve may have to be manually opened. Cold shutdown actions can be delayed without limit.

Zones 2084DD and 2111T

Cables for the service water outlet valves from both Diesel Generator jacket coolers are in each of these zones. A fire in either zone along with a loss of offsite power might cause a need for one of those valves to be manually opened. As noted in Appendix A (A-2.1.f) of our July 1, 1982, submittal, the diesel is not required for at least 1½ hours following a loss of offsite power, i.e., until primary system makeup is required.

Zone 2084DD also has a cable for all but one Emergency Feedwater pump discharge valves and several of the valves themselves are physically in this zone. A fire in this zone might cause a need to use feed and bleed cooling or to manually open 2CV-1039 or to manually open 2CV-1036 and 2CV-1075. None of those three valves are physically located within Zone 2084DD nor would a fire in that zone make them inaccessible. Emergency feedwater is required no earlier than 20 minutes on ANO-2.

Zone 2097X

Cables for the green and swing battery chargers are in this zone. If the red battery charger is out of service (as permitted for unlimited time periods by the technical specifications) and a fire in this zone disabled the green and swing battery chargers, the black battery charger would need to be connected to the red battery. Even so, we consider the probability of simultaneous occurrence of this Technical Specification condition and a fire in the same zone extremely small.

The battery banks will carry their loads for a least 8 hours without charging. Therefore, connection of a battery bank to an alternate operable charger would be needed no earlier than within 8 hours.

Zone 2155A

The atmospheric dump valves are both in this zone. To achieve cold shutdown one may need to be manually opened. Cold shutdown actions can be delayed without limit.

Item 3:

List all the actions required of the operator including the times in which the operator has to bring the plant to hot and cold shutdown by means of the alternate shutdown capability independent of the control room and cable spreading room. List manpower requirements for various tasks. Provide a commitment and schedule for implementing procedures for bringing the plant to hot and cold shutdown.

Response:

Actions required of the operator to bring the plant to hot shutdown by means of the alternate shutdown system with a loss of all AC power, except those corrective actions that may be necessitated by random hot shorts in the cable spreading room or control room in order to permit the listed actions to be accomplished, are listed in sections A.2.1e and f of Appendix A of our July 1, 1982, submittal. The listed components can be operated from the breaker (preferred) or (in the case of valves) by local manual valve operator manipulation. The listings include the manpower requirements for the various tasks. It should be noted that these actions are the same as those required for a loss of all AC power without a fire for the first 1½ hours, with the sole difference being the location at which the necessary process variables are monitored. Step 1 in the list can be delayed in excess of 10 minutes (much longer for Unit 2) without violating margin to saturation limits. Step 2 is stated in the submittal as having an acceptable delay time of 1½ hours. Step 3 timing requirements will depend on how tight the Reactor Coolant System is and, to some extent, how long Step 1 was delayed, but will be required until some time beyond the 1½ hour acceptable delay period for Step 2. Step 4 may be delayed without limit.

To achieve cold shutdown the operator will have to continue Steps 3 and 4 in a manner that will depressurize and cool the Reactor Coolant System to approximately 280°F/250 psig where the decay heat system can be put into operation to bring the unit to cold shutdown. There is no time limit for this task.

Section A.2.1e of our July 1, 1982, submittal commits to revisions to existing procedures to address the occurrence of a fire in the control room. These revisions will be implemented after completion of our proposed alternate shutdown design modifications. The schedule for completion of those modifications is addressed in Section 5 of our July 1, 1982, submittal. The procedure revisions will address both hot and cold shutdown.

Item 4:

NUCLEAR UTILITY FIRE PROTECTION GROUP

SUITE 700
1200 SEVENTEENTH STREET, N. W
WASHINGTON, D. C 20036
(202) 857-9833

March 28, 1983

M E M O R A N D U M

To: Nuclear Fire Protection Group

From: J. Michael McGarry
Malcolm H. Philips

Subj: Summary of March 16, 1983 Group Meeting

On March 16, 1983, the Fire Protection Group ("Group") met at the offices of Debevoise & Liberman in Washington, D.C. for the purposes of (1) reviewing the status of the Appendix R exemption request appeal process, (2) exchanging experiences regarding the appeal process, (3) discussing the pending Appendix R I&E inspection process, and (4) as appropriate, charting direction of Group activities. A list of attendees is attached hereto (Attachment A). Representatives from I&E attended a portion of the meeting and responded to questions from Group members regarding topics of interest. Due to the length of these discussions, the remaining agenda items were discussed only briefly. A summary of discussions involving the NRC representatives, and discussions of Group members regarding items on the meeting agenda are as follows:

I. GROUP DISCUSSIONS WITH I&E

The three members of the I&E staff present during the meeting were (1) Jim Taylor (Director, Division of Quality Assurance, Safeguards & Inspection Programs); (2) Jim Stone (Chief of Construction Programs/Construction Appraisal Team); and (3) Leon Whitney, Assistant to Taylor responsible for coordinating the fire protection inspection program. During the meeting, Taylor provided his perspectives on the inspection process and responded to a list of Group questions and concerns provided to him before the meeting. A summary of his comments and responses are set forth below:

require that reactivity control functions be capable of monitoring reactivity conditions. Would you please comment on this.

A5. I&E agrees with the perspectives stated in this comment.

Q6. In the inspection module regarding safe shutdown requirements of Appendix R (at Section 41, paragraph d), it states that the inspections will verify that "redundant trains of cables and equipment in selected fire areas have been identified and analyzed by the licensee . . . ." What is the verification process to be utilized?

A6. On an audit basis, I&E will review analyses of the licensee to determine if fire areas have been identified and analyzed appropriately. This process is what is meant by verification.

Q7. In the module on safe shutdown requirements for Appendix R (at Appendix 3), it notes that licensees will be given credit for certain activities. Please explain the process to be used in giving such credit.

A7. Credit will be given for inspections previously conducted by I&E in accordance with the other I&E modules referenced in Appendix 3.

Q8. The following comments relate to Appendix 1 of the module on safe shutdown requirements for Appendix R:

a. Section A.2.d

Too much emphasis is to be placed on the routing and tracing of control circuits. In many instances, licensees, with the concurrence of ASB, are taking manual control of pumps at switchgear or motor control centers. Alternatively, isolation devices and transfer switches are used to provide isolation from potentially damaged control circuits. Also, recognition of the use of manual operation of valves, recognized by ASB, should be embodied in the general guidance given here.

Aa. I&E will accept the ASB perspectives on this issue.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
Washington, D.C. 20555

INSPECTION AND ENFORCEMENT MANUAL

DQASIP

TEMPORARY INSTRUCTION 2515/62, REV.1

SUPERSEDED

INSPECTION OF SAFE SHUTDOWN REQUIREMENTS OF 10CFR50, APPENDIX R (SECTION III.G) AT NUCLEAR POWER PLANTS LICENSED TO OPERATE BEFORE JANUARY 1, 1979

2515/62-01 PURPOSE

To ascertain whether required licensees are in conformance with Section III.G of 10CFR50, Appendix R, including exemptions approved by the Office of Nuclear Reactor Regulation (NRR), U.S. Nuclear Regulatory Commission.

2515/62-02 BACKGROUND

Effective February 17, 1981, the Nuclear Regulatory Commission amended its regulations by adding Section 50.48 and Appendix R to 10CFR50 to require certain provisions for fire protection in operating nuclear power plants. 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 protection equivalent to the technical requirements of III.G.

2515/62-03 GENERAL INFORMATION

031 It is recommended that a team be assigned to perform this inspection. The following is a suggested minimum team.

a. Team Leader - leads discussion with licensee at entrance and exit interview. Should be a region-based inspector. Also participates in inspection effort.

*b. Safe Shutdown Specialist - inspects the safe shutdown systems, equipment, and circuits.

*c. Fire Protection Specialist - inspects fire protection of the safe shutdown systems, equipment, and circuits.

032 This is a technically complex inspection. Because there are many variations in the technical details by which a facility can meet safe shutdown criteria, a site-specific inspection

*Regions may use inspectors who have the necessary expertise, request assistance from NRR, or use IE contractors who have the necessary expertise.

APPENDIX 1

INSPECTION PLAN PREPARATION

A. Document Review

Because the inspection of the safe shutdown requirements of Appendix R (10CFR50, Section III.G) is a complex undertaking, it is important that the personnel selected to perform the inspection be prepared before they arrive at the site.

1. Following is a list of documents that inspection personnel should obtain and review before the inspection.

   a. NRR letter, dated November 24, 1980, from D. G. Eisenhut to all power reactor licensees with plants licensed before January 1, 1979. This letter details the SER open items that were applicable to each operating plant.

   b. NRR Generic Letter No. 81-12, dated February 20, 1981, from D. G. Eisenhut to all power reactor licensees with plants licensed before January 1, 1979. This letter requests that certain information be included in licensee submittals in response to 10CFR50.48 and Appendix R requirements.

   c. NRR letters to licensees, that provided clarification of the requirements of Generic Letter 81-12. These letters were issued on various days during 1982. (See Appendix 2 to this temporary instruction for exact date.)

   d. Licensee responses to NRR letters of Items A.1.a. b, and c, and exemption requests.

   e. Fire Hazard Analysis and related documents prepared by the licensee before January 1, 1979.

   f. NRR Fire Protection Safety Evaluation Report and supplements, and licensee documents referenced therein that provide the NRR review and approval of the Fire Hazards Analysis of Item A.1.e.*

   g. NRR Fire Protection Safety Evaluation Report and licensee documents referenced therein that provide the NRR review and approval of modifications required to satisfy the alternative or dedicated shutdown requirement of Section III.G.3 of Appendix R.*

   h. Exemptions granted or denied by NRR.*

*The dates of these items may be obtained from the NRR project manager.

or equivalent) and locates the safe shutdown equipment and cables by fire area (part of this may include Item A.1.e by reference).

j. NRR memorandum from Mattson to Vollmer dated July 2, 1982, "Position Statement on Allowable Repairs for Alternative Shutdown and on the Appendix R Requirement for Time Required to Achieve Cold Shutdown." Copies were sent to the Regional Division Directors by J. M. Taylor on August 17, 1982.

k. Memorandum from L. S. Rubenstein to Roger J. Mattson dated January 7, 1983, "Statement of Staff Position Regarding Source Range Flux, Reactor Coolant Temperature, and Steam Generator Pressure Indication to Meet Appendix R Alternative Shutdown Capability."

2. From the documentation develop the following information:

   a. Equipment required for hot shutdown.

   b. Additional equipment required for cold shutdown.

   c. Areas of the plant where alternative shutdown capability has been provided.

   d. Areas of the plant that contain components or cable runs (control, power or instrumentation) from both redundant trains of equipment required for hot and cold shutdown.

3. The licensee should be asked to provide the following information, if it is not available in the regional office:

   a. Emergency operating procedures or equivalent that are used to achieve and maintain the plant in hot shutdown following a fire.

   b. Emergency operating procedures or equivalent that are used to cool down the plant following a fire.

   c. Results of tests run (if any) to verify the ability to maintain the plant in hot shutdown following a fire with an assumed loss of offsite power (e.g., natural circulation test while using the atmospheric steam dumps).

   d. Any documents identified in A.1 that were prepared by the licensee.

B. Hot Shutdown Capability

1. System/Equipment/Instrumentation

   a. From the list of systems, equipment, and instrumentation required to achieve and maintain hot shutdown, select a

Reviewed 12/88

BG: C
Search

File / Fire Protection

RULEMAKING ISSUE
(Information)

July 5, 1983 | SECY-83-269

For: The Commissioners

From: William J. Dircks
Executive Director for Operations

Subject: FIRE PROTECTION RULE FOR FUTURE PLANTS (SECY 82-267)

Reference: Memorandum from S. J. Chilk to W. J. Dircks, dated August 13, 1982.

Purpose: To provide a report in response to the referenced memorandum which summarizes the licensee's fire protection exemption requests, the staff's disposition of those requests, and generic issues that were raised by the requests. This report includes a description of the types of exemptions requested and the safety significance of those requests. In addition it provides a summary of research results and a discussion of the impact these results have on the staff's view of fire protection requirements, including the need for revisions to the present fire protection guidelines.

Discussion: After the Browns Ferry fire in March 1975, the NRC published guidelines for the review of the fire protection programs in nuclear power plants. Licensees compared their fire protection programs to these guidelines. As a result, the licensees proposed facility modifications. The staff completed their evaluation of these proposed modifications by the end of 1978. At that time, 15 fire protection issues remained unresolved with several licensees.

On October 27, 1980, the Commission approved a new paragraph 50.48 and Appendix R to 10 CFR 50 which set forth the Commission's requirements for resolving these 15 issues at all plants licensed prior to January 1, 1979, and for backfitting of three sections of Appendix R to all operating plants. Paragraph 50.48 also set a schedule for the implementation of these requirements.

Contact:
F. Nolan, NRR
49-28007

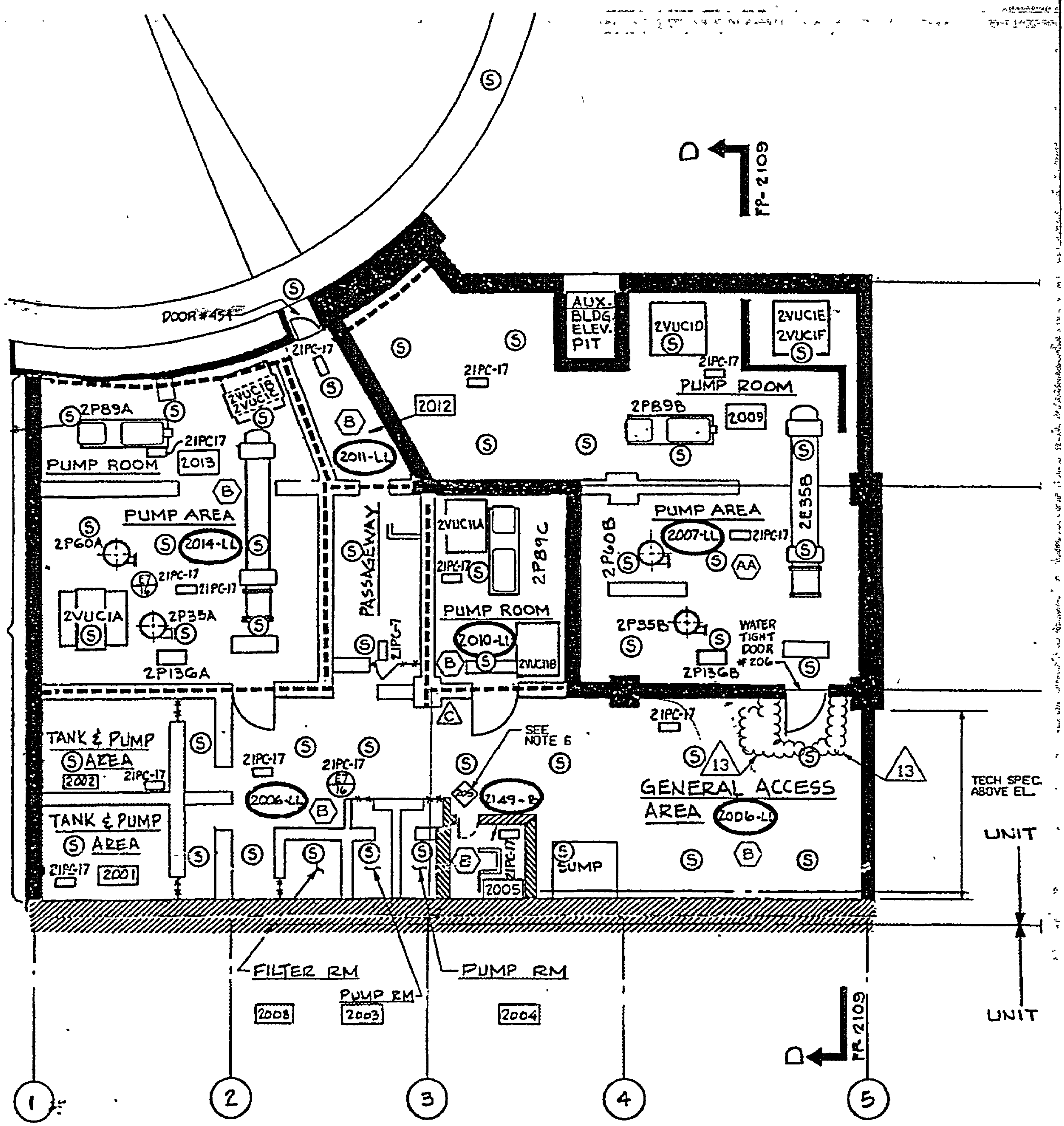
We have been using and propose to continue to use Sections III.L.1 and III.L.5 in our evaluations. Thus, a licensee should have the capability of repairing equipment and achieving cold shutdown within 72 hours using only onsite power. The 72 hours is considered an upper limit; a licensee may limit the repairs and achieve cold shutdown in a shorter time frame.

b. Allowable Repairs to Achieve Safe Shutdown

Section III.G of Appendix R states that repairs are permitted to provide the cold shutdown capability. Additionally, Section III.L indicates that procedures for these repairs must be developed and materials needed for the repairs stored on site. To establish consistency in the plant designs, the staff issued the following guidelines concerning repairs. (memorandum R. Mattson to R. Vollmer, dated July 2, 1982)

> Section III.G.1 of Appendix R states that one train of systems needed for hot shutdown must be free of fire damage. Thus, one train of systems needed for safe shutdown has to be operable during and following the fire. Operability of the hot shutdown systems, including the ability to overcome a fire or fire suppressant induced maloperation of hot shutdown equipment and the plant's power distribution system, must exist without repairs. Manual operation of valves, switches and circuit breakers is allowed to operate equipment and isolate systems and is not considered a repair. However, the removal of fuses for isolation is not permitted. All manual operations must be achievable prior to the fire or fire suppressant induced maloperations reaching an unrecoverable plant condition.

Modifications, e.g., wiring changes, are allowed to systems and/or components not used for hot shutdown, whose fire or fire suppressant induced maloperations may indirectly affect hot shutdown. These repairs must be achievable prior to the maloperations causing an unrecoverable plant condition.



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2014-LL
21PC-17
2VUCIA
2P35A
2P136A
PASSAGEWAY
2VUCHA
2P89C
PUMP ROOM
2010-LL
2VUCH8
21PC-7
PUMP AREA
2P60B
2007-LL
2E35B
2P35B
WATER TIGHT DOOR #206
2P136B
TANK & PUMP AREA
2002
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2006-LL
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2006-LL
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WORKSHOP

Enclosure 4

Chemical Engineering Branch/Fire Protection Section
Staff Guidance for Compliance with Appendix R
to 10 CFR 50

Appendix R . Section III. G. 1. a

POSITION: One train of systems necessary for hot shutdown shall be free of fire damage.

GUIDANCE: (Systems necessary for hot shutdown)

- Sections 4 and 6 of Staff Position - Safe Shutdown Capability, June 19, 1979
- Sections 4 and 6 of Generic Letter 81-12, Feb. 20, 1981
- Section V of IE Notice 84-09, February 13, 1984

GUIDANCE: (Free of fire damage)

- Section C.1.b of CMEB 9.5-1, July, 1981
- Section 1.2.1 of Attachment A and Section b of Attachment C to SECY 83-269, July 5, 1983
- Section III of IE Notice 84-09, February 13, 1984*

Section III.G.1.b

POSITION: Systems necessary for cold shutdown can be repaired within 72 hours.

 JUN 5 [redacted]

Docket Nos. 50-313
[redacted]

LICENSEE: Arkansas Power & Light Company (AP&L)

FACILITY: Arkansas Nuclear One, Units 1 & 2 (ANO-1&2)

SUBJECT: SUMMARY OF MEETING OF APRIL 27, 1984 WITH ARKANSAS POWER AND LIGHT COMPANY CONCERNING APPENDIX R ANALYSIS FOR ANO-1&2

At the request of the licensee, Arkansas Power & Light Company (AP&L), a meeting was held at 8:45 A.M., on April 27, 1984, in Bethesda, Maryland. The purpose of the meeting was to discuss the methodology used by the licensee in reanalyzing the fire protection features at ANO-1&2 for conformance to the specific requirements of Appendix R to 10 CFR 50. The reanalysis was required since AP&L, when conducting its original analysis of the fire protection features at ANO-1&2, interpreted certain requirements of Appendix R in a manner that was not consistent with the staff's positions. A list of attendees is provided in Enclosure 1.

The licensee presented several examples of the fire area analyses performed to date to illustrate the methodology used in its reanalysis. The staff commented that the methodology used appeared to be consistent with the staff's positions. It was agreed that the licensee would clearly document the methodology used in its reanalysis and would specifically request our review.

During the meeting, several questions were raised by the licensee. The questions and the NRC staff's responses are noted below:

Question 1: Should AP&L request schedular exemptions for those modifications whose implementation dates have been passed?

Response: No. However, AP&L should report them to the NRC Regional Office. The report should address appropriate interim actions taken to compensate for those delays.

Question 2: Should AP&L request technical exemptions emanating from the analysis conducted in response to Generic Letter 83-33?

Response: No. However, it is recommended that AP&L submit the evaluation which would have been used as a basis for the technical exemption for our review.

In addition, some concerns were raised during the discussion whether the design of ANO-1 Emergency Feedwater System (EFWS) complies with specific requirements of Item III.G of Appendix R. It was agreed that AP&L would submit for our review an analysis of the design of the EFWS with respect to Item III.G of Appendix R.

REANALYSIS AGAINST 10CFR50 APPENDIX R SECTIONS III.G, J AND O

I. INTRODUCTION

A. Background

In 1977-78, Arkansas Power & Light Company (AP&L) conducted a fire hazards analysis study for Arkansas Nuclear One Units 1 and 2 (ANO-1&2) to meet the criteria of Appendix A to the Auxiliary Power Conversion Systems Branch (APCSB) Branch Technical Position 9.5-1 (BTP 9.5-1). The results of this study were submitted to the NRC in February of 1978 (ØCANØ278Ø5). Subsequent to that submittal, AP&L was requested via correspondence to respond to numerous additional fire protection questions and to make regulatory commitments to complete certain modifications. Additionally, the ANO fire protection program was documented in the NRC staff's ANO-1 and 2 Fire Protection Safety Evaluation Reports (SERs) dated August 22, 1978 (1CNAØ87891), and August 30, 1978 (2CNAØ87826), respectively.

On November 19, 1980, the NRC published the Fire Protection Rule, 10CFR50.48, and its guidance for implementation of that rule, Appendix R to 10CFR50. The effective date of the regulation was February 17, 1981. By letter (ØCANØ381Ø6) dated March 19, 1981, AP&L requested exemption from the requirements of Sections III.G and III.L of Appendix R, on the basis previous modifications conducted in accordance with the 1978 SERs assured the protection of the public health and safety, and additional modifications in accordance with Appendix R would not increase that protection significantly.

Subsequent to that request, AP&L stated in correspondence(ØCANØ182Ø3) dated January 15, 1982, it was unable to commit to any firm schedule for submitting specific, technically sound requests for exemption from Appendix R requirements. By letter (1CNAØ582Ø2) dated May 10, 1982, the NRC granted AP&L an extension to July 1, 1982, to submit specific exemption requests and proposed modifications pertaining to the requirements of 10CFR50.48 and Appendix R.

On July 1, 1982, AP&L submitted the results of its Appendix R compliance review and specific exemption requests via correspondence (ØCANØ782Ø2). Subsequent to that submittal, additional correspondence was sent to the NRC which provided clarification and revised exemption requests (ØCAN11821Ø). The exemptions were approved in the staff's Safety Evaluation (SE) (ØCANØ38328) dated March 22, 1983.

During the period following the initial Appendix R submittal date and the date the SE was received, AP&L received indication from its association with the Nuclear Utility Fire Protection Group (NUFPG) that the methodology used in conducting its analysis might not be consistent with NRC interpretations of the rule. Several "generic" issues were discussed at NUFPG meetings from December 1982 through February 1983.

On March 1, 1983, the NUFPG met with several NRC staff members to discuss these issues. As a result of that meeting, AP&L determined it would be necessary to reanalyze ANO to determine the extent of compliance with the staff's interpretations of the requirements of Section III.G of Appendix R. Hence, AP&L submitted a "blanket" exemption request for all barriers and all suppression/detection systems on March 28, 1983, (ØCANØ38322) to ensure it would be able to complete its reanalysis in accordance with the perceived staff interpretations.

During June and July 1983, AP&L had the opportunity to review, through the NUFPG, several draft versions of the staff positions regarding Appendix R requirements discussed at the March 1 meeting. These criteria were in draft form, and did not appear to be consistent between subsequent drafts. Hence, AP&L decided to halt its reanalysis of ANO and, in its letter dated July 12, 1983 (ØCANØ783Ø5), requested definitive written guidance be provided by the NRC.

The NRC provided AP&L with this guidance in a letter dated September 14, 1983 (ØCNAØ983Ø3). Subsequent to that letter, all licensees received, via Generic Letter 83-33, that same guidance. After receiving that guidance, AP&L reinitiated its reanalysis of ANO in accordance with the NRC staff's interpretation and undertook an extensive verification program. Additionally, AP&L received further regulatory clarification concerning Appendix R at the NRC fire protection workshop held in Arlington, Texas, on April 26, 1984. This report documents the results of AP&L's reanalysis of ANO in accordance with the NRC guidance on the requirements of Appendix R to 10CFR50 relative to Section III.G, J and O.

As stated in the cover letter (ØCANØ884Ø4) accompanying this document, following NRC review and concurrence that AP&L has properly incorporated the information presented in Generic Letter No. 83-33, IE Information Notice No. 84-09, and the April 26, 1984, NRC Region IV workshop, the following can be considered to supercede our March 28, 1983 (ØCANØ38322), "blanket" exemption request referenced above.

B. Scope

This report documents the results of the reanalysis of the safe shutdown capability of ANO-1 and 2, and contains requests for exemptions to 10CFR50 Appendix R Sections III.G, J, and O resulting from that reanalysis as appropriate.

III. EVALUATION OF SAFE SHUTDOWN CAPABILITY AGAINST APPENDIX R, SECTION III.G, AS CLARIFIED BY NRC REGION IV WORKSHOP HELD IN ARLINGTON, TEXAS, APRIL 26, 1984

A. Introduction and Purpose

This section of the report provides a description of the methods used to reevaluate Arkansas Nuclear One (ANO) Units 1 and 2 against the criteria of Section III.G of Appendix R to 10CFR50. Specific exemptions are requested where appropriate, and modifications are described where needed.

The purpose of this safe shutdown analysis is to determine the extent of ANO's compliance with Appendix R as clarified by previously mentioned NRC guidance concerning that regulation. The analysis is used to assure the nuclear power station in question can be safely shut down with fire damage present. The extent of this damage and various initial conditions are defined by Appendix R.

B. Initial Conditions and Assumptions

The reanalysis of ANO-1 and 2 was performed under the initial conditions defined by Appendix R to 10CFR50. Those conditions are consistent with those utilized in AP&L's original Appendix R compliance submittal dated July 1, 1982 (ØCANØ782Ø2), and subsequent correspondence dated November 11, 1982 (ØCAN11821Ø). The following briefly summarize the conditions assumed.

This safe shutdown analysis for Appendix R was performed assuming a loss of offsite power condition. No equipment failures are considered other than those resulting from the postulated fire. Fire damaged cables are assumed to fail in the worst mode for the conditions under evaluation. For example, if it is worse for a given valve to open than it is for that valve to remain closed, then the control cable for that valve is assumed to be damaged by the postulated fire in such a manner as to cause a signal to be transmitted to the valve which will cause it to open.

Where adequate time is available, and the valve is not physically located in the vicinity of the postulated fire, credit is taken for manual operation of manually operable valves. For valves required for cold shutdown only, credit is taken for manual operation even if the valve in question is located within the area of postulated fire damage. Additionally, credit has been taken for all embedded conduit remaining undamaged by fire.

Safe shutdown, for the purposes of this analysis, is defined to mean hot shutdown, as is consistent with the Licensing basis and design of the units. However, cold shutdown must be achievable. No credit is taken for any manual action which would normally be considered repair, e.g., rewiring.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

April 24, 1986

To ALL POWER REACTOR LICENSEES AND APPLICANTS FOR POWER REACTOR LICENSES

Gentlemen:

SUBJECT: IMPLEMENTATION OF FIRE PROTECTION REQUIREMENTS (GENERIC LETTER 86-10)

In the Spring of 1984, the Commission held a series of Regional Workshops on the implementation of NRC fire protection requirements at nuclear power plants. At those workshops, a package of recently developed NRC guidance was distributed to each attendee which included NRC staff responses to industry questions and a document titled "Interpretations of Appendix R." The cover memo for the package explained that it was a draft package which would be issued in final form via Generic Letter following the workshops.

The guidance approved by the Commission is appended to this letter, and is in the same format as the draft package, i.e., "Interpretations of Appendix R" and responses have been modified from the draft package, and a number of industry questions raised at or subsequent to the workshops have been added and answered. This package represents recent staff assessment of these questions and provides guidance as to acceptable methods of satisfying Commission regulatory requirements. Other methods proposed by licensees for complying with Commission regulations may also be satisfactory and will be considered on their own merits. To the extent that this guidance may be inconsistent with prior guidance (including Generic Letter 83-33), it is intended that the current letter takes precedence.

If you have any questions, you should contact the NRC Project Manager for your facility.

In the lettered sections below, some additional topics are covered which also bear on the interpretation and implementation of NRC fire protection requirements. The topics are: (A) schedular exemptions, (B) revised inspection program, (C) documentation required to demonstrate compliance, (D) quality assurance requirements applicable to fire protection systems, (E) notification of the NRC when deficiencies are discovered, and (F) addition of fire protection program into FSAR.

A. Schedular Exemption

The Appendix R implementation schedule was established by the Commission in 10 CFR 50.48(c), promulgated together with Appendix R in November of 1980. Allowing time to evaluate the need for alternative or dedicated shutdown systems, which require prior NRC approval before installation, and time for design of and NRC review of such systems, the Commission envisioned that implementation of Appendix R would be complete in 4 to 5 years, or approximately by the end of 1985. Many schedule extensions were granted by the

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staff under the "tolling provision" 50.48(c)(6), and under 10 CFR 50.12, the longest of which now extends into 1987. Some licensees have proceeded expeditiously to implement Appendix R and are now finished or nearly finished with that effort. Others have engaged in lengthy negotiations with the staff while continuing to file requests for schedule extensions, and thereby have barely begun Appendix R modifications needed to comply with Section III.G and III.L. Schedule extension requests have been received seeking implementation dates of 1990 or beyond.

As the 50.48(c) schedule was intended to be a one-time schedule commencing in the 1980-1982 time frame and ending in the 1985 time frame, extensions well beyond this schedule (particularly where major modifications remain to be completed) undermine the purpose of the schedule, which was to achieve expeditious compliance with NRC fire Protection requirements. For that reason, additional schedular exemptions may be requested under 10 CFR 50.12, but such requests will be granted sparingly based on the following criteria:

1. The utility has, since the promulgation of Appendix R in 1980, proceeded expeditiously to meet the Commission's requirements.

2. The delay is caused by circumstances beyond the utility's control.

3. The proposed schedule for completion represents a best effort under the circumstances.

4. Adequate interim compensatory measures will be taken until compliance is achieved.

The NRC is currently reviewing all dockets of plants covered by the 50.48 schedule to determine schedule deadlines. When this review is completed, each licensee will be informed of the deadlines.

B. Revised Inspection Program

In 1982, the NRC developed an inspection program to verify compliance with the requirements of 10 CFR 50, Appendix R. This program was primarily oriented towards reviewing safe shutdown features of those pre-1979 licensees that had completed Appendix R modifications and selected NTOL plants. From 1982 to the present, a number of Appendix R compliance inspections have been performed. In many of the initial inspections it was found that licensees had made significant errors in implementing a number of Appendix R requirements.

The NRC will continue to conduct inspection of fire protection features. In the case of completed modifications, the inspection team will review compliance with applicable requirements. In the case of incomplete modification, the inspection team will review licensee approach to compliance, plans and schedules for completing such modifications. The NRC will attempt to review implementation of fire protection features on a schedule that will minimize the chances of licensees implementing features in a manner that does not meet with staff approval. Additionally, requests for this review and/or inspection by licensees will be granted within NRC resource constraints.

C. Documentation Required to Demonstrate Compliance

The "Interpretations" document attached to this letter states that, where the licensee chooses not to seek prior NRC review and approval of, for example, a fire area boundary, an evaluation must be performed by a fire protection engineer (assisted by others as needed) and retained for future NRC audit. Evaluations of this type must be written and organized to facilitate review by a person not involved in the evaluation.

Guidelines for what such an evaluation should contain may be found in: (1) Section B of Appendix R and (2) Section C.1.b of Branch Technical Position (BTP) CMEB 9.5-1 Rev. 2 dated July 1981. All calculations supporting the evaluation should be available and all assumptions clearly stated at the outset. The NRC intends to initiate enforcement action where, for a given fire area, compliance with Appendix R is not readily demonstrable and the licensee does not have available a written fire hazard analysis for the area. The term "readily demonstrable" includes situations where compliance is apparent by observation of the potential fire hazard and the existing protective features.

D. Quality Assurance Requirements Applicable

For fire protection systems the licensee should have and maintain a quality assurance program that provides assurance that the fire protection system will be designed, fabricated, erected, tested, maintained and operated so that they will function as intended. Fire protection systems are not "safety-related" and are therefore not within the scope of Appendix B to 10 CFR Part 50, unless the licensee has committed to include these systems under the Appendix B program for the plant. NRC guidance for an acceptable quality assurance program for fire protection systems, given in Section C.4 of Branch Technical Position CMEB 9.5-1 Rev. 2 dated July 1981, has generally been used in the review and acceptance of approved fire protection programs for plants licensed after January 1, 1979. For plants licensed prior to January 1, 1979, similar guidance was referenced in footnotes 3 and 4 to 10 CFR 50.48. They are contained in BTP APCSB 9.5-1 and Appendix A thereto and in "Nuclear Plant Fire Protection Functional Responsibilities, Administrative Control and Quality Assurance" dated June 14, 1977.

E. Notification of the NRC When Deficiencies are Discovered

Licensees are reminded of their obligation to notify the NRC of fire protection deficiencies which meet the criteria of 10 CFR 50.72 or 10 CFR 50.73 as applicable.

F. Addition of Fire Protection Program into FSAR

Most licenses contain a section on fire protection. License conditions for plants licensed prior to January 1, 1979, contain a condition requiring implementation of modifications committed to by the licensee as a result of the BTP review. These license conditions were added by amendments issued between 1977 and February 17, 1981, the effective date of 10 CFR 50.48 and Appendix R.

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Two points should be noted in regard to these conditions: (1) they did not explicitly cover required fire protection features where modifications to the existing plant configuration or procedures were not required, and (2) some of the provisions in these conditions may have been superseded by Sections III.G, J, O, and L of Appendix R.

License conditions for plants licensed after January 1, 1979 vary widely in scope and content. Some only list open items that must be resolved by a specified date or event, such as exceeding five percent power or the first refueling outage. Some reference a commitment to meet Appendix R; some reference the FSAR and/or the NRC staff's SER. These variations have created problems for licensees and for NRC inspectors in identifying the operative and enforceable fire protection requirements at each facility.

These license conditions also create difficulties because they do not specify when a licensee may make changes to the approved program without requesting a license amendment. If the fire protection program committed to by the licensee is required by a specific license condition or is not part of the FSAR for the facility, the provisions of 10 CFR 50.59 may not be applied to make changes without prior NRC approval. Thus licensees may be required to submit amendment requests even for relatively minor changes to the fire protection program.

The aforementioned problems, in general, exist because of the many submittals that constitute the fire protection program for each plant. The Commission believes that the best way to resolve these problems is to incorporate the fire protection program and major commitments, including the fire hazards analysis, by reference into the Final Safety Analysis Report (FSAR) for the facility. In this manner, the fire protection program, including the systems, the administrative and technical controls, the organization, and other plant features associated with fire protection would be on a consistent status with other plant features described in the FSAR. Also, the provisions of 10 CFR 50.59 would then apply directly for changes the licensee desires to make in the fire protection program that would not adversely affect the ability to achieve and maintain safe shutdown. In this context, the determination of the involvement of an unreviewed safety question defined in 150.59(a)(2) would be made based on the "accident.... previously evaluated" being the postulated fire in the fire hazards analysis for the fire area affected by the change. The Commission also believes that a standard license condition, requiring licensees to comply with the provisions of the fire protection program as described in the FSAR, should be used to ensure uniform enforcement of fire protection requirements.

Therefore, each licensee should include, in the FSAR update required by 10 CFR 50.71(e) that will fall due more than 6 months after the date of this letter, the incorporation of the fire protection program that has been approved by the NRC, including the fire hazards analysis and major commitments that form the basis for the fire protection program. This incorporation may be by reference to specific previous submittals and the NRC approvals where appropriate. Upon completion of this effort, including the certification required by 10 CFR 50.71(e)(2), the licensee may apply for an amendment

to the operating license which amends any current license conditions regarding fire protection and substitutes the following standard condition:

Fire Protection

(Name of Licensee) shall implement and maintain in effect all provisions of the approved fire protection program as described in the Final Safety Analysis Report for the facility (or as described in submittals dated ____________) and as approved in the SER dated ____________(and Supplements dated ____________) subject to the following provision:

The licensee may make changes to the approved fire protection program without prior approval of the Commission only if those changes would not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire.

The licensee may alter specific features of the approved program provided (a) such changes do not otherwise involve a change in a license condition or technical specification or result in an unreviewed safety question (see 10 CFR 50.59), and (b) such changes do not result in failure to complete the fire protection program as approved by the Commission. As with other changes implemented under 10 CFR 50.59, the licensee shall maintain, in auditable form, a current record of all such changes, including an analysis of the effects of the change on the fire protection program, and shall make such records available to NRC Inspectors upon request. All changes to the approved program shall be reported annually to the Director of the Office of Nuclear Reactor Regulation, along with the FSAR revisions required by 10 CFR 50.71(e).

Temporary changes to specific fire protection features which may be necessary to accomplish maintenance or modifications are acceptable provided interim compensatory measures are implemented.

At the same time the licensee may request an amendment to delete the technical specifications that will now be unnecessary.

Inclusion of the fire protection program in the FSAR will be a prerequisite for licensing for all now under review. The standard license condition will be included in new licenses.

Sincerely,

Darrell G. Eisenhut, Deputy Director
Office of Nuclear Reactor Regulation

Enclosures:
1. Interpretations of Appendix R
2. Appendix R Questions and Answers
3. Fire Protection License Condition

ENCLOSURE 1

INTERPRETATIONS OF APPENDIX R

1. Process Monitoring Instrumentation

Section III.L.2.d of Appendix R to 10 CFR Part 50 states that "the process monitoring function shall be capable of providing direct readings of the process variables necessary to perform and control" the reactivity control function. In I&E Information Notice 84-09, the staff provides a listing of instrumentation acceptable to and preferred by the staff to demonstrate compliance with this provision. While this guidance provides an acceptable method for compliance with the regulation, it does not exclude other alternative methods of compliance. Accordingly, a licensee may propose to the staff alternative instrumentation to comply with the regulation (e.g., boron concentration indication). While such a submittal is not an exemption request, it must be justified based on a technical evaluation.

2. Repair of Cold Shutdown Equipment

Section III.L.5 of Appendix R states that when in the alternative or dedicated shutdown mode, "equipment and systems comprising the means to achieve and maintain cold shutdown conditions shall not be damaged by fire; or the fire damage to such equipment and systems shall be limited so that the systems can be made operable and cold shutdown can be achieved within 72 hours." This is not to be confused with the requirements in Section III.G.1.b of Appendix R.

Section III.G.1.b contains the requirements for normal shutdown modes utilizing the control room or emergency control station(s) capabilities. The fire areas falling under the requirements of III.G.1.b are those for which an alternative or dedicated shutdown capability is not being provided. For these fire areas, Section III.G.1.b requires only the capability to repair the systems necessary to achieve and maintain cold shutdown from either the control room or emergency control station(s) within 72 hours, not the capability to repair and achieve cold shutdown within 72 hours as required for the alternative or dedicated shutdown modes by Section III.L (noted above).

With regard to areas involving normal shutdown, however, Section I of Appendix R states that repairs must be made using only onsite capabilities. After repairs are made, cold shutdown can be achieved on a reasonable schedule using any available power source.

3. Fire Damage

Appendix R to 10 CFR Part 50 utilizes the term "free of fire damage." In promulgating Appendix R, the Commission has provided methods acceptable for assuring that necessary structures, systems and components are free of fire damage (see Section III.G.2a, b and c), that is, the structure, system or

/*/ These interpretations represent staff positions, and should not be considered as official agency interpretations issued by the General Counsel. See 10 CFR 1.32; 10 CFR Part 8.

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component under consideration is capable of performing its intended function during and after the postulated fire, as needed. Licensees seeking exemptions from Section III.G.2 must show that the alternative proposed provides reasonable assurance that this criterion is met. (Note also that Section III.G.2 applies only to equipment needed for hot shutdown. Therefore, an exemption from III.G.2 for cold shutdown equipment is not needed. The term "damage by fire" also includes damage to equipment from the normal or inadvertent operation of fire suppression systems.

4. Fire Area Boundaries

The term "fire area" as used in Appendix R means an area sufficiently bounded to withstand the hazards associated with the area and, as necessary, to protect important equipment within the area from a fire outside the area. In order to meet the regulation, fire area boundaries need not be completely sealed floor-to-ceiling, wall-to-wall boundaries. However, all unsealed openings should be identified and considered the evaluating the effectiveness of the overall barrier. Where fire area boundaries are not wall-to-wall, floor-to-ceiling boundaries with all penetrations sealed to the fire rating required of the boundaries, licensees must perform an evaluation to assess the adequacy of fire boundaries in their plants to determine if the boundaries will withstand the hazards associated with the area. This analysis must be performed by at least a fire protection engineer and, if required, a systems engineer. Although not required, licensees may submit their evaluations for staff review and concurrence. However, if certain cable penetrations were identified as open SER items at the time Appendix R became effective, Section III.M of the rule applies (see 10 CFR 50.48(b)), and any variation from the requirements of Section III.M requires an exemption. In any event, these analyses must be retained by the licensees for subsequent NRC audits.

5. Automatic Detection and Suppression

Sections III.G.2.b and III.G.2.c of Appendix R state that "In addition, fire detectors and automatic fire suppression system shall be installed in the fire area..." Other provisions of Appendix R also use the phrase "fire detectors and an automatic fire suppression system in the fire area..." (see e.g., Section III.G.2.e).

In order to comply with these provisions, suppression and detection sufficient to protect against the hazards of the area must be installed. In this regard, detection and suppression providing less than full area coverage may be adequate to comply with the regulation. Where full area suppression and detection is not installed, licensees must perform an evaluation to assess the adequacy of partial suppression and detection to protect against the hazards in the area. The evaluation must be performed by a fire protection engineer and, if required, a systems engineer. Although not required, licensees may submit their evaluations to the staff for review and concurrence. In any event, the evaluations must be retained for subsequent NRC audits. Where a licensee is providing no suppression or detection, and exemption must be requested.

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6. Alternative or Dedicated Shutdown

Section III.G.3 of Appendix R provides for "alternative or dedicated shutdown capability and its associated circuits, independent of cables, systems or components in the area, room, or zone under consideration." While "independence" is clearly achieved where alternative shutdown equipment is outside the fire area under consideration. this is not intended to imply that alternative shutdown equipment in the same fire area but independent of the room or the zone cannot result in compliance with the regulation. The "room" concept must be justified by a detailed fire hazards analysis that demonstrates a single fire will not disable both normal shutdown equipment and the alternative shutdown capability.

ENCLOSURE 2

APPENDIX R QUESTIONS AND ANSWERS

APPENDIX R
QUESTIONS AND ANSWERS

APPENDIX R QUESTIONS & ANSWERS 2

1. INTRODUCTION

A major fire damaging safe shutdown equipment occurred at the Browns Ferry Nuclear Station in March 1975. The fire damaged over 1600 electrical cables and caused the temporary unavailability of some core cooling systems. Because this fire did substantial damage, the NRC established a Special Review Group which initiated an evaluation of the need for improving the fire protection programs at all nuclear power plants. The group found serious design inadequacies regarding fire protection at Browns Ferry, and its report, "Recommendations Related to Browns Ferry Fire" (NUREG-0050, February 1976), contained over fifty recommendations regarding improvements in fire prevention and control in existing facilities. The report also called for the development of specific guidance for implementing fire protection regulations, and for a comparison of that guidance with the fire protection program at each operating plant.

NRC developed technical guidance from the technical recommendations in the Special Group's report, and issued those guidelines as Branch Technical Position Auxiliary and Power Conversion Systems Branch 9.5-1 (BTP APCSB 9.5-1), 1/ "Guidelines for Fire Protection for Nuclear Power Plants." This guidance did not apply to plants docketed at that time. Guidance to operating plants was provided later in Appendix A 2/ to BTP APCSB 9.5-1 which, to the extent practicable, relies on BTP APCSB 9.5-1.

In May 1976, the NRC asked licensees to compare operating reactors with BTP APCSB 9.5-1, and in September 1976, those licensees were informed that the guidelines in Appendix A would be used to analyze the consequences of a fire in each plant area. In September 1976 the licensees, were also requested to provide a fire hazards analysis that divided the plant into distinct fire areas and show that redundant systems required to achieve and maintain cold shutdown are adequately protected against damage by a fire. Early in 1977 each licensee responded with a Fire Protection Program Evaluation which included a Fire Hazard Analysis. These evaluations and analyses identified aspects of licensees' fire protection programs that did not.conform to the NRC guidelines.

1/ Rather than serving as inflexible, legal requirements that must be followed by licensees, issuances such as regulatory guides and branch technical positions are meant to give guidance to licensees concerning those methods the staff finds acceptable for implementing the general criteria embodied in the NRC's rules. See, e.g., Petition for Emergency & Remedial Action, CLI-78-6, 7 NRC 400, 406 (1978); Gulf States Utilities Company (River Bend Station, Units 1 and 2) ALAB-444, 6 NRC 760, 772 (1977).

2/ Guidelines for Fire Protection for Nuclear Power Plants Docketed Prior to July 1, 1976.

Thereafter, the staff initiated discussions with all licensees aimed at achieving implementation of fire protection guidelines by October 1980. The staff held many meetings with licensees, conducted extensive correspondence with them, and visited every operating reactor. As a result, many fire protection items were resolved, and agreements were included in Fire Protection Safety Evaluation Reports issued by the NRC. Several fire protection issues remained unresolved with a number of licensees.

By early 1980, most operating plants had implemented most of the guidelines in Appendix A. However, as the Commission noted in its Order of May 23, 1980, the fire protection program has had some significant problems with implementation. Despite the staff's efforts, several licensees had expressed continuing disagreement with, and refused to adopt recommendations relating to several generic issues, including the requirements for fire brigade size and training, water supplies for fire suppression systems, alternate and dedicated shutdown capability, emergency lighting, qualifications of seals used to enclose places where cables penetrated fire barriers, and the prevention of reactor coolant pump lubrication system fires. To establish a definitive resolution of these contested subjects in a manner consistent with the general guidelines in Appendix A to the BTP and to assure timely compliance by licensees, the Commission issued a proposed fire protection rule and its Appendix R, which was described as setting out minimum fire protection requirements for the unresolved issues (45 Fed. Req. 36082 May 29, 1980).3/ The fire protection features addressed included protection of safe shutdown capability, emergency lighting, fire barriers, associated circuits, reactor coolant pump lubrication system, and alternate shutdown systems. The Commission stated that it expected all modifications (except for alternate and dedicated shutdown capability) to be implemented by November 1, 1980.4/

As originally proposed (Federal Register Vol. 45 No. 1&5, May 22, 1980), Appendix R would have applied to all plants licensed prior to January 1, 1979 including those for which the staff had previously accepted other fire protection modifications. After analyzing comments on the rule, the Commission determined that only three of the fifteen items in Appendix R were of such safety significance that they should apply to all plants, including those for which alternative fire protection actions had been approved previously by the staff. These items are protection of safe shutdown capability (including alternate shutdown systems), emergency lighting, and the reactor coolant pump lubrication system. Accordingly, the final rule required all reactors licensed to operate before January 1, 1979, to comply with these three items even if the NRC had previously approved alternative fire protection features in these areas (45 Fed. Reg. 76602 Nov. 19, 1980). However, the final rule is more flexible than the proposed rule because Item III.G now provides three alternative fire protection features which do not require analysis to demonstrate the protection of redundant safe shutdown equipment, and reduces the acceptable distance in the physical separation alternative from fifty feet to twenty feet. In addition, the rule now also provides an exemption procedure which can be initiated by a licensee's assertion that any required fire protection feature will not enhance fire protection safety in the facility or that such modifications may be detrimental to overall safety (10 CFR 50.48(c)(6)). If the Director, Nuclear Reactor Regulation determines

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3/11 NRC 707, 718 (1980)
4/Id. at 719

that a licensee has made a prima facie showing of a sound technical basis for such an assertion, then the implementation dates of the rule are tolled until final Commission action on the exemption request.

Most licensees requested and were granted additional time to perform their reanalysis, propose modifications to improve post fire shutdown capability and to identify exemptions for certain fire protection configurations. In reviewing some exemption requests, the staff noted that some licensees had made significantly different interpretations of certain requirements. These differences were identified in the staff's draft SER's. These differences were also discussed on several occasions with the cognizant licensee as well as the Nuclear Utility Fire Protection Group. These discussions culminated in the issuance of generic letter 83-33.

2. OVERVIEW

Section 50.48 Fire Protection of 10 CFR Part 50 requires that each operating nuclear power plant have a fire protection plan that satisfies General Design Criterion 3 of Appendix A to 10 CFR 50. It specifies what should be contained in such a plan and lists the basic fire protection guidelines for this plan. It requires that the Fire Protection Safety Evaluation Report which has been issued for each operating plant state how these guidelines were applied to each facility.

Section 50.48 also requires that all plants with operating licenses prior to January 1, 1979 satisfy the requirements of Section III.6, III.J and III.O, and other Sections of Appendix R where approval of similar features had not been obtained prior to the effective date of Appendix R. By a separate action, the Commission approved the staff's requirement that all plants to receive their operating license after January 1, 1979 also satisfy the requirements of Sections III.G, III.J and III.O and that a fire protection license condition be established. Deviations from Appendix R requirements for pre-1979 plants are processed under the exemption process. Deviation from other guidelines are identified and evaluated in the Safety Evaluation Report.

A standard fire protection license condition has been developed and will be included in each new operating license. Holders of operating licenses will be encouraged to adopt the standard license condition.

The Regions initiated inspections of operating plants and identified several significant items of non-compliance. The Nuclear Utility Fire Protection group requested interpretations of certain Appendix R requirements and provided a list of questions that they thought should be discussed with the industry. The NRC held workshops in each Region to assist the industry in understanding the NRC's requirements and to improve the Staff's understanding of the industry's concerns.

This document presents the NRC's response to the questions posed by the industry and supplemented with additional questions identified at the workshops as being of interest to the industry or the staff. These responses may be used as guidance for design, review and inspection activities. The questions have been reformatted according to their applicability to Sections of Appendix R, BTP CMEB 9.5-1, licensing policy or inspection policy.

3. SECTION III G, FIRE PROTECTION OF SAFE SHUTDOWN CAPABILITY

3.1 Fire Area Boundaries

3.1.1 Fire Area Definition

QUESTION

Section III.G states the fire protection features required for cables and equipment or redundant trains of systems required to achieve and maintain hot shutdown that are located within the same fire area. Is the fire area of Section III.G, the same fire area referred to in BTP APCSB 9.5-1, Appendix A; and the supplementary guidance of September 1976?

RESPONSE

The definition of a fire area given in the BTP is somewhat more restrictive than that given in Section #4 of the "Interpretations of Appendix R." Clearly, where a licensee has reviewed its facility using the BTP criteria, this would meet Appendix R requirements. The BTP criteria may continue to be used as guidance, but the minimum requirements for fire area boundaries are set out in Section #4 of the "Interpretations."

3.1.2 Previously Accepted Fire Area Boundaries

QUESTION

If a fire area boundary was described as a rated barrier in the 1977 fire hazards analysis (FHA), no open items existed in this area in the Appendix A SER, and the barriers have not been altered, then need those barriers be reviewed by licensees or the Staff under Appendix R?

RESPONSE

If a fire area boundary was described as a rated barrier in the 1977 fire hazards analysis, and was evaluated and accepted in a published SER, the fire area boundary need not be reviewed as part of the re-analysis for compliance with Section III.G of Appendix R. Openings in the fire barriers, if any, should have been specifically identified and justified in the fire hazards analysis performed in the Appendix A process. If openings in the fire area boundaries were not previously evaluated, such an evaluation should be performed as a basis for assessing compliance with Appendix R. See Items #4 and #6 of the "Interpretations of Appendix R," and the response to question 3.1.1.

In BTP APCSB 9.5-1, Fire Barrier is defined as:

"Fire Barrier - those components of construction (walls, floors, and roofs) that are rated by approving laboratories in hours for resistance to fire to prevent the spread of fire.

The term "fire area" as used in Appendix R means an area sufficiently bounded to withstand the hazards associated with the fire area and, as necessary, to protect important equipment within the fire area from a fire outside the area. In order to meet the regulation, fire area boundaries need not be completely

sealed with floor to ceiling and/or wall-to-wall boundaries. Where fire area boundaries were not approved under the Appendix A process, or where such boundaries are not wall-to-wall or floor-to-ceiling boundaries with all penetrations sealed to the fire rating required of the boundaries, licensees must perform an evaluation to assess the adequacy of fire area boundaries in their plants to determine if the boundaries will withstand the hazards associated with the area and protect important equipment within the area from a fire outside the area. This analysis must be performed by at least a fire protection engineer and, if required, a systems engineer. Although not required, licensees may submit their evaluations for Staff review and concurrence. In any event, these analyses must be retained by the licensees for subsequent NRC audits.

3.1.3 Exterior Wall's

QUESTION

Must exterior walls to buildings and their penetrations be qualified as rated barriers?

RESPONSE

Exterior walls and their penetrations should be qualified as rated barriers when (1) they are required to separate a shutdown-related division(s) inside the plant from its redundant (alternate) counterpart outside the plant in the immediate vicinity of the exterior wall, (2) they separate safety related areas from non-safety related areas that present a significant fire threat to the safety related areas, or (3) they are designated as a fire barrier in the FSAR or FHA.

Usually exterior walls are designated as a fire area boundary; therefore, they are evaluated by the guidelines of Appendix A. A FHA should be performed to determine the rating of exterior walls, if required by the above criteria.

3.1.4 Exterior Yards

QUESTION

How should a utility define the boundaries of fire areas comprising exterior yards?

RESPONSE

An exterior yard area without fire barriers should be considered as one fire area. The area may consist of several fire zones. The boundaries of the fire zones should be determined by a FHA.

The protection for redundant/alternate shutdown systems within a yard area would be determined on the bases of the largest "design basis fire" (see response to question 3.8.2) that is likely to occur and the resulting damage. The boundaries of such damage would have to be justified with a fire hazards analysis. The analysis should consider the degree of spatial separation between divisions; the presence of in-situ and transient combustibles, including vehicular traffic; grading; available fire protection; sources of ignition; and the vulnerability and criticality of the shutdown related systems. See Sections #3, #4 and #6 of the "Interpretations of Appendix R."

3.1.5 Fire Zones

QUESTION

Appendix R, Section III.G.3 states "alternative or dedicated shutdown capability and its associated circuits, independent of cables, systems or components in the area room or zone under consideration...." What is the implied utilization of a room or zone concept under Section III.G of

Appendix R? The use of the phraseology "area, room or zone under consideration" is used again at the end of the Section III.G.3. Does the requirement for detection and fixed suppression indicate that the requirement can be limited to a fire zone rather than throughout a fire area? Under what conditions and with what caveats can the fire zone concept be utilized in demonstrating conformance to Appendix R?

RESPONSE

Section III.G was written after NRC's multi-discipline review teams had visited all operating power plants. From these audits, the NRC recognized that it is not practical and may be impossible to subdivide some portions of an operating plant into fire areas. In addition, the NRC recognized that in some cases where fire areas are designated, it may not be possible to provide alternate shutdown capability independent of the fire area and, therefore, would have to be evaluated on the basis of fire zones within the fire area. The NRC also recognized that because some licensees had not yet performed a safe shutdown analysis, these analyses may identify new unique configurations.

To cover the large variation of possible configurations, the requirements of Section III.G were presented in three Parts:

Section III.G.1 requires one train of hot shutdown systems be free of fire damage and damage to cold shutdown systems be limited.

Section III.G.2 provides certain separation, suppression and detection requirements within fire areas; where such requirements are met, analysis is not necessary.

Section III.G.3 requires alternative dedicated shutdown capability for configurations that do not satisfy the requirements of III.G.2 or where fire suppressants released as a result of fire fighting, rupture of the system or inadvertent operation of the system may damage redundant equipment. If alternate shutdown is provided on the basis of rooms or zones, the provision of fire detection and fixed suppression is only required in the room or zone under consideration.

Section III.G recognizes that the need for alternate or dedicated shutdown capability may have to be considered on the basis of a fire area, a room or a fire zone. The alternative or dedicated capability should be independent of the fire area where it is possible to do so (See Supplementary Information for the final rule Section III.G). When fire areas are not designated or where it is not possible to have the alternative or dedicated capability independent of the fire area, careful consideration must be given to the selection and location of the alternative or dedicated shutdown capability to assure that the performance requirement set forth in Section III.G.1 is met. Where alternate or dedicated shutdown is provided for a room or zone, the capability must be physically and

electrically independent of that room or zone. The vulnerability of the equipment and personnel required at the location of the alternative or dedicated shutdown capability to the environments produced at that location as a result of the fire or fire suppressant's must be evaluated. These environments may be due to the hot layer, smoke, drifting suppressants, common ventilation systems, common drain systems or flooding. In addition, other interactions between the locations may be possible in unique configurations.

If alternate shutdown is provided on the basis of rooms or zones, the provision of fire detection and fixed suppression is only required in the room or zone under consideration: Compliance with Section III.G.2 cannot be based on rooms or zones.

See also Sections #5 and #6 of the "Interpretations of Appendix R."

3.1.6 Documentation

QUESTION

In Generic Letter 83-33 at pg. 2, the NRC Staff referred to the guidance in Appendix A to BTP 9.5-1 to establish the rating of the barrier. What level of documentation must be provided to verify that the fire area meets the requirements of Appendix R?

RESPONSE

The documentation required to verify the rating of a fire barrier should include the design description of the barrier and the test reports that verify its fire rating. Reference can be made to UL listed designs.

3.2 Fire Barrier Qualification

3.2.1 Acceptance Criteria

QUESTION

Recently the Staff has applied a 325 F cold side temperature criterion to its evaluation of the acceptability of one-hour and three-hour fire barrier cable tray wraps. This criterion is not in Branch Technical Position (BTP) APCSB 9.5-1, Appendix A as an acceptance criterion for fire barrier cable tray wraps and is not contained in Appendix R. It appears to represent post-Appendix R guidance. What is the origin of this criterion and why is it applicable to electrical cables where insulation degradation does not begin until jacket temperatures reach 450 F to 650 F?

RESPONSE

Fire barriers relied upon to protect shutdown related systems to meet the requirements of III.G.2 need to have a fire rating of either one or three hours. 50.48 references BTP APCSB 9.5-1, where the fire protection definitions are found. Fire rating is defined:

"Fire Rating - the endurance period of a fire barrier or structure; it defines the period of resistance to a standard fire exposure before the first critical point in behavior is observed (see NFPA 251)."

The acceptance criteria contained in Chapter 7 of NFPA 251, "Standard Methods of Fire Tests of Building Construction and Materials," pertain to non-bearing fire barriers. These criteria stipulate that transmission of heat through the barrier "shall not have been such as to raise the temperature on its unexposed surface more than 250 F above its initial temperature." The ambient air temperature at the beginning of a fire test usually is between 50 F and 90 F. It is generally recognized that 75 F represents an acceptable norm. The resulting 325 F cold side temperature criterion is used for cable tray wraps because they perform the fire barrier function to preserve the cables free of fire damage. It is clear that cable that begins to degrade at 450 F is free of fire damage at 325 F.

During the Appendix A review, licensees began to propose fire barriers to enclose cable trays, conduit, fuel lines, coolant lines, etc. Industry did not have standard rating tests for such components or for electrical, piping or bus duct penetrations. The NRC issued a staff position giving acceptance criteria for electrical penetration tests. These criteria require an analysis of any temperature on the unexposed side of the barrier in excess of 325 F. In the past, manufacturers designed their own qualification tests. Nuclear Insurers, and the Institute of Electrical and Electronic Engineers have issued tests for some of these components. These tests usually exposed the component to the ASTM E-119 time temperature curve, but all had different acceptance criteria. Conduit and cable tray enclosure materials accepted by the NRC as 1 hour barrier prior to Appendix R (e.g. some Kaowool and 3M materials) and already installed by the licensee need not be replaced even though they may not have met the 325 F criteria. However, for newly identified conduit and cable trays requiring such wrapping new material which meets the 325 F criterion should be used, or justification should be provided for use of material which does not meet the 325 F criterion. This may be based on an analysis demonstrating that the maximum recorded temperature is sufficiently below the cable insulation ignition temperature.

3.2.2 Deviations from Tested Configurations

QUESTION

Due to obstructions and supports, it is often impossible to achieve exact duplication of the specific tested configuration of the one-hour fire barriers which are to be placed around either conduits or cable trays. For each specific instance where exact replication of a previously tested configuration is not and cannot be achieved, is an exemption necessary in order to avoid a citation for a violation?

RESPONSE

No. Where exact replication of a tested configuration cannot be achieved, the field installation should meet all of the following criteria:

1. The continuity of the fire barrier material is maintained.

2. The thickness of the barrier is maintained.

3. The nature of the support assembly is unchanged from the tested configuration.

4. The application or "end use" of the fire barrier is unchanged from the tested configuration. For example, the use of a cable tray barrier to protect a cable tray which differs in configuration from those that were tested would be acceptable. However, the use of structural steel fire proofing to protect a cable tray assembly may not be acceptable.

5. The configuration has been reviewed by a qualified fire protection engineer and found to provide an equivalent level of protection.

3.2.3 Fire Door Modifications

QUESTION

Where labeled and rated fire doors have been modified to incorporate security hardware or for flooding protection, is an exemption from Appendix R required?

RESPONSE

Where a door is part of a fire area boundary, and the modification does not effect the fire rating (for example, installation of security "contacts"), no further analysis need be performed. If the modifications could reduce the fire rating (for example, installation a vision panel), the fire rating of the door should be reassessed to ensure that it continues to provide adequate margin considering the fire loading on both sides. Since this reassessment pertains to the establishment of a valid fire area boundary, an exemption is not required. See Section #4 of the "Interpretations of Appendix R."

3.3 Structural Steel

3.3.1 NFPA Approaches

QUESTION

Does the NRC's definition of structural steel supporting fire barriers completely accommodate approaches described in NFPA guidance documents and standards?

RESPONSE

The NRC does not define the structural steel supporting fire barriers. This steel is identified by the licensee. Our position regarding the need to protect the structural steel, which forms a part of or supports fire barriers, is consistent with sound fire protection engineering principles as delineated in both NFPA codes and standards, and The Fire Protection Handbook.

3.3.2 Previously Accepted Structural Steel

QUESTION

Is it necessary to protect structural steel in existing fire barriers where those barriers were approved in an Appendix A SER?

RESPONSE

No.

3.3.3 Seismic Supports

QUESTION

Does structural steel whose sole purpose is to carry dynamic loads from a seismic event require protection in accordance with Section III.G.2a of Appendix R?

RESPONSE

No, unless the failure of any structural steel member due to a fire could result in significant degradation of the fire barrier. Then it must be protected.

3.3.4 Cable Tray Support Protection

QUESTION

Should cable tray supports be protected if there is a sprinkler system in the fire area? Under what conditions may cable tray supports be unprotected? Do unprotected supports require an exemption?

RESPONSE

In general, cable tray supports should be protected, regardless of whether there is a sprinkler system. However, they need not be protected if (1) the qualification tests were performed on wrapped cable trays with unprotected supports, and the supports are shown to be adequate, or (2) an analysis is performed, which takes into account the fire loading and automatic suppression available in the area, and which demonstrates that the unprotected support(s) will not fail and cause a loss of the cable tray fire barrier required for the postulated fire.

An exemption is not required; however, the qualification tests and applicability or the structural evaluation should be documented and available for audit.

3.4 Automatic Suppression System

3.4.1 Water Density

QUESTION

Staff guidance provided in Generic Letter 83-33* concerning automatic suppression coverage of fire areas interprets the phrase "in the fire area" in Section III.G as meaning "throughout the fire area." What delivered water density or occupancy standard as specified in NFPA-STD-13 must be achieved to meet this guidance?

RESPONSE

Individual plant areas are diverse in nature. The designer should determine the particular water density or occupancy classification. Those areas which contain a limited quantity of in-situ and anticipated transient combustibles

*Superseded by Generic Letter 85-01, however the response to the question is useful for other considerations.

and which feature contents such as tanks and piping, may be considered as "Ordinary Hazard (Group 1)," as defined by NFPA Standard No. 13. For those areas containing large amounts of cables or flammable liquids, an occupancy classification of "Extra Hazard" may be warranted. The decision as to which classification should be applied should be made by a qualified fire protection engineer.

Once the occupancy classification is determined, the minimum water density should be based on the Density Curves in table 2.2.1(B) of NFPA 13. Any density equal to or in excess of the curves would be in conformance with our guidelines as delineated in Section C.6.c of BTP CMEB 9.5-1.

3.4.2 NRC Consultation

QUESTION

Section 4.1.2 of NFPA-STD-13 allows for "partial installations" or partial coverage. The standard states that "the authority having jurisdiction shall be consulted in each case." With the NRC as authority in this instance, must consultation occur only through the exemption process?

RESPONSE

No. The staff is always available to consult with utility representatives and provide guidance as to the acceptability of a particular fire protection configuration in individual plant areas. See also Section #5 of the "Interpretations of Appendix R."

3.4.3 Sprinkler Location

QUESTION

How does a suppression system designer know whether the term "throughout the area" means that sprinkler heads must be above or below cable trays when, in his judgment, the hazard of concern is a floor based fire?

RESPONSE

Section C.6.c(3) of BTP CMEB 9.5-1 states:

"(3) Fixed water extinguishing systems should conform to requirements of appropriate standards such as NFPA-13, "Standard for the Installation of Sprinkler Systems," and NFPA-15, "Standard for Water Spray Fixed Systems".

This question pertains to those sprinkler systems covered by NFPA-13. Chapter 4 of NFPA-13 provides guidance as to the location of sprinkler heads in relation to common obstructions. In general, to achieve complete area wide coverage, sprinklers should be located at the ceiling, with additional sprinklers provided below significant obstructions such as wide HVAC ducts and "shielded" or solid bottom stacked cable trays. To the extent that an existing or proposed sprinkler system design deviates from this concept, the design would have to be justified by a fire hazards analysis. See also Section #5 of the "Interpretations of Appendix R."

3.4.4 Fixed Suppression System In Fire Area

QUESTION

Are fixed suppression systems required by Section III G.3 to be throughout the fire area, room or zone under consideration?

RESPONSE

No, but partial coverage must be properly justified and documented.

See Item #5 of the "Interpretations of Appendix R."

"...suppression less than full area coverage may be adequate to comply with the regulation. Where full area suppression and detection is not installed, licensees must perform an evaluation to assess the adequacy and necessity of partial suppression and detection in an area. The evaluation must be performed by a fire protection engineer and, if required, a systems engineer. Although not required, licensees may submit their evaluations to the staff for review and concurrence. In any event, the evaluations must be retained for subsequent NRC audits..."

3.4.5 Sprinkler Head Location

QUESTION

If stacks of horizontal or vertical cable trays extend from ceiling to floor, are sprinkler heads required (1) under the lowest horizontal trays, near the floor for vertical trays; (2) at some intermediate level between the floor and ceiling, and (3) at the ceiling?

RESPONSE

Sprinkler heads should be located at the ceiling. Sprinkler heads at other locations may be necessary depending upon the hazard and the cumulative effect of the obstructions to the discharge of water from the sprinkler head. The sprinkler system design should meet NFPA 13.

3.4.6 Previously Approved Suppression Systems

QUESTION

Must suppression systems approved and installed under BTP APCSB 9.5-1. Appendix A be extended or altered to meet the total area requirements of Section III.G (as interpreted by the Staff) or does this "requirement" only apply to new installations?

RESPONSE

Suppression systems installed in connection with Appendix A may or may not have to be extended as a result of III.G. The licensee must analyze each area where suppression is required by III.G, and where only partial suppression has been provided, determine if the coverage is adequate for the fire hazard in the area. The licensee may consult with the staff during this review. In any event, the

Appendix R analysis showing that the suppression provided is adequate must be retained and available for NRC audit. See also Section #5 of the "Interpretations of Appendix R."

3.5 Separation of Redundant Circuits

3.5.1 Twenty-Foot Separation Criteria

QUESTION

Assuming that a licensee is utilizing the 20-foot separation for circuit protection, could an exemption request be granted for a portion of the circuit that did not maintain the 20-foot minimum separation if that portion was protected by one-hour barrier until 20-foot was achieved? This barrier would not be firewall-to-firewall, and the circuit protection would not be claimed under the one-hour barrier rule.

RESPONSE

With the erection of a partial qualified one-hour rated barrier for portions of the circuits with less than 20 ft. separation, if 20 feet of horizontal separation existed between the redundant unprotected portions of the circuits without intervening combustibles or fire hazards, and if the fire area was protected by automatic fire detection and suppression, compliance with Section III.G.2.b would be achieved.

These types of configuration have to be evaluated on a case-by-case basis by the NRC.

3.5.2 Floor-to-Floor Separation

QUESTION

Where redundant circuits are separated by floor elevation but are within the same fire area due to open hatchways, stairs, etc., what is the NRC's position with regard to separation criteria? If train A is located twenty feet from an open hatchway on the lower elevation and train B is located ten feet from the same opening on the next elevation, would this be considered adequate separation?

RESPONSE

If a wall or floor/ceiling assembly contains major unprotected openings such as hatchways and stairways, then plant locations on either side of such a barrier must be considered as part of a single fire area. Refer to Section #4 of the "Interpretations of Appendix R."

As to the example provided, if train A was separated by a cumulative horizontal distance of 20 feet from train B, with no intervening combustible materials or fire hazards, and both elevations were provided with fire detection and suppression, the area would be in compliance with Section III.G.2.b.

3.6 Intervening Combustibles

3.6.1 Negligible Quantities of Intervening Combustibles

QUESTION

Twenty feet of separation with absolutely no intervening combustibles is a rare case in most nuclear plants. What is the most acceptable method of addressing intervening combustibles? How are various utilities addressing this subject, and what would be sufficient justification to support an exemption request?

RESPONSE

If more than negligible quantities of combustible materials (such as isolated cable runs) exist between redundant shutdown divisions, an exemption request should be filed. [Negligible quantity" is an admittedly judgmental criterion, and this judgment should be made by a qualified fire protection engineer and documented for later NRC audit.] Justifications for such exemptions have been based on the following factors:

1. A relatively large horizontal spatial separation between redundant divisions; all cables qualified to IEEE-383.

2. The presence of an automatic fire suppression system over the intervening combustible (such as a cable tray fire suppression system);

3. The presence of fire stops to inhibit fire propagation in intervening cable trays;

4. The likely fire propagation direction of burning intervening combustibles in relation to the location of the vulnerable shutdown division;

5. The availability of compensating active and passive fire protection.

Any future changes in the cable configuration due to modifications could be handled under 50.59. See the provisions of the license condition in the response to question 8.2.

3.6.2 In-Situ Exposed Combustibles

QUESTIONS

Within Appendix R, Section III.G.2.b, the phrase "twenty feet with no intervening combustible or fire hazards" is utilized. What is the definition of "no intervening combustible?" Is the regulation focused predominantly on the absence of fixed combustibles?

RESPONSE

There is no specific definition of "no intervening combustible." The regulation is focused on the absence of in-situ exposed combustibles. Non combustible materials would not be considered as intervening combustibles.

In BTP CMEB 9.5-1, noncombustible material is defined as:

"Noncombustible Material

a. A material which in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat.

b. Material having a structural base of noncombustible material, as defined in a., above, with a surfacing not over 1/8-inch thick that has a flame spread rating not higher than 50 when measured using ASTM E-84 Test "Surface Burning Characteristics of Building Materials."

In Generic Letter 83-33, we state:

"Staff Position: Section III.G.2.b requires the "separation ...with no intervening combustibles ..." To meet this requirement, plastic jackets and insulation of grouped electrical cables, including those which are coated, should be considered as intervening combustibles."

For fire protection, "no intervening combustibles" means that there is no significant quantities of in-situ materials which will ignite and burn located between redundant shutdown systems. The amount of such combustibles that has significance is a judgmental decision. As with other issues, if the licensees fire protection engineer is concerned that the quantity of combustibles between shutdown divisions may not be considered insignificant by an independent reviewer, an exemption could be requested or the staff consulted.

Transient materials are not considered as an intervening combustible; however, they must be considered as part of the overall fire hazard within an area.

Cables that are in cable trays which are either open or fully enclosed should also be considered as intervening combustibles. Cables coated with a fire retardant material are also considered as intervening combustibles.

However, cables coated with a fire retardant material, or cables in cable trays having solid sheet metal bottom, sides and top, if protected by automatic fire detection and suppression systems and if the design is supported by a fire hazards analysis, have been found acceptable under the exemption process.

3.6.3 Unexposed Combustibles

QUESTION

Are unexposed combustibles, such as oil in sumps, closed cans, or sealed drums, or electrical cable in conduits, considered as "intervening combustibles?"

RESPONSE

Only oil in closed containers which are in accordance with NFPA 30 or electrical cables in metal conduits are not considered as intervening combustibles. In situ oil in open sumps is considered to be an intervening combustible; in-situ oil in closed sumps equivalent to NFPA Standard-30 containers is not considered to be an intervening combustible.

Radiant Energy Shield

3.7.1 Fire Rating

QUESTION

Recently, the NRC Staff indicated that non-combustible radiant energy shields should be tested against ASTM-TD-E-119 based, apparently, on the requirements of BTP CMEB 9.5-1, Rev. 3, a document issued after Appendix R was promulgated. This new requirement would not appear to be required by Appendix R or BTP APCSB 9.5-1 Appendix A. Could the Staff clarify the requirements in this area?

RESPONSE

During the Appendix A reviews, we observed that inside some containments, there were large concentrations of cables converging at electrical penetration areas. In some cases, where the penetrations were grouped by division, shields were placed between the divisions so that radiant energy from a fire involving the cables of one division would not degrade or ignite cables of the other divisions. These shields also directed the convective energy from the fire away from the surviving division. These shields were usually constructed of 1/2-inch marinite board in a metal frame. Appendix R, Section III.G.f refers to these shields as "a noncombustible radiant energy shield." The guidelines in BTP CMEB 9.5-1, Section C.7.a(1)b. indicate that these shields should have a fire rating of 1/2 hour. In our opinion any material with a 1/2 hour fire rating should be capable of performing the required function.

The guidelines of BTP CMEB 9.5-1 relating to a fire-rated radiant energy shield are being considered in our current reviews of NTOL plants. However, to the extent that an applicant can justify that a proposed radiant energy shield can achieve an equivalent level of safety, we have been accepting shields that have not been tested against the acceptance criteria of ASTM E-119.

In our Appendix R reviews, we have accepted non-fire-rated radiant energy shields that have been demonstrated by fire hazards analysis to provide an acceptable level of protection against the anticipated hazard of a localized fire within the containment. We have also accepted fire-rated metal-sheathed mineral insulated cables, as a radiant energy shield in specific configurations.

3.8 Design Bases

3.8.1 Fire Protection Features NFPA Conformance

QUESTION

Should the fire protection features required by Section III.G conform to the NFPA Codes?

RESPONSE

Yes. For example, Section III G.2 requires an automatic suppression system. Our guidelines would recommend that the systems be in accordance with an NFPA Code. If deviations are made from the Code, they should be identified in the FSAR or FHA.

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3.8.2 Design Basis Fire

QUESTION

Why isn't the industry allowed to design to protect against a design basis fire?

RESPONSE

Neither the industry nor the Staff has been able to develop criteria for establishing design basis fire conditions for a single "design basis fire" because the in-situ and potential transient combustibles vary widely in different areas of the plant. However, the establishment of a specific "design basis fire" for individual fire areas or zones is a prerequisite to performance of a valid fire hazards analysis (See Appendix R Section II.B(1) and BTP CMEB 9.5-1 Sections C.b(1) and (2)).

3.8.3 Redundant Trains/Alternate Shutdown

QUESTION

Confusion exists as to what will be classified as an alternate shutdown system and thus what systems might be required to be protected by suppression and detection under Section III.G.3.b. For example, while we are relying upon the turbine building condensate system for a reactor building fire and the RHR system for a turbine building fire, would one system be considered the alternative to the other. If so, would suppression and detection be required for either or both systems under III.G.3.b? An explanation of alternative shutdown needs to be advanced for all licensees.

RESPONSE

If the system is being used to provide its design function, it generally is considered redundant. If the system is being used in lieu of the preferred system because the redundant components of the preferred system does not meet the separation criteria of Section III.G.2, the system is considered an alternative shutdown capability. Thus, for the example above, it appears that the condensate system is providing alternative shutdown capability in lieu of separating redundant components of the RHR System. Fire detection and a fixed fire suppression system would be required in the area where separation of redundant components of the RHR system is not provided. However, in the event of a turbine building fire, the RHR system would be used for safe shutdown and is not considered an alternative capability. However, one train of the RHR system must be separated from the turbine building.

3.8.4 Control Room Fire Considerations

QUESTION

What considerations should be taken into account in a control room fire? What is the damage that is considered? What actions can the operators take before evacuating the CR? When can the control room be considered safe after a fire for the operator to return?

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RESPONSE

The control room fire area contains the controls and instrumental redundant shutdown systems in close proximity (i.e. usually separation is a few inches). Because it is possible to provide shutdown capability that is physically and electrically independent of the fire area, it is our opinion that alternative or dedicated shutdown capability and its associated circuits for the control room be independent of the cables system and components in the control room fire area.

The damage to the system in the control room for a fire that causes evacuation of the control room cannot be predicted. A bounding analysis should be made to assure that safe conditions can be maintained from outside the control room. This analysis is dependent to the specific design. The usual assumption are:

1. The reactor is tripped in the control room.

2. Offsite power is lost as well as automatic starting of the onsite a.c. generators and the automatic function of valves and pumps whose control circuits could be affected by a control room fire.

The analysis should demonstrate that capability exists to manually achieve safe shutdown conditions from outside the control room by restoring a.c. power to designated pumps, assuring that valve lineup is correct, and assuming that any malfunctions of valves that permit the loss of reactor coolant can be corrected before unrestorable conditions occur.

Note that the only manual action in the control room prior to evacuation usually given credit for is the reactor trip. For any additional control room actions deemed necessary prior to evacuation, a demonstration of the capability of performing such actions would have to be provided. Additionally, assurance would have to be provided that such actions could not be negated by subsequent spurious actuation signals resulting from the postulated fire.

After the fire, the operators could return to the control room when the following conditions have been met:

1. The fire has been extinguished and so verified by appropriate fire protection personnel.

2. The control room has been deemed habitable by appropriate fire protection personnel and the shift supervisor.

3. Damage has been assessed and, if necessary, corrective action has been taken to assure necessary safety, control and information systems are functional (some operators may assist with these tasks) and the shift supervisor has authorized return of plant control to the control room.

4. Turnover procedures which assure an orderly transfer of control from the alternate shutdown panel to the control room has been completed. After returning to the control room, the operators can take any actions compatible with the condition of the control room. Controls in any area (cabinet where the fire occurred would not be available. Smoke and fire suppressant

damage in other areas (cabinets) must also be assessed and corrective action taken before controls in such cabinets are deemed functional. Controls in undamaged area (cabinets) could be operated as required. Minor modifications inside the control room may be performed to reach cold shutdown.

4. EMERGENCY LIGHTING

4.1 Illumination Levels

QUESTION

What is the requisite intensity level for emergency lighting for egress routes and areas where shutdown functions must be performed? What are the bases for determining these levels of lighting?

RESPONSE

The level of illumination provided by emergency lighting in access routes to and in areas where shutdown functions must be performed is a level that is sufficient to enable an operator to reach that area and perform the shutdown functions. At the remote shutdown panels the illumination levels should be sufficient for control panel operators.

The bases for estimating these levels of lighting are the guidelines contained in Section 9.5.3 of the Standard Review Plan, which are based on industry standards (i.e., Illuminating Engineering Society Handbook).

Where a licensee has provided emergency lighting per Section III.J Appendix R, we would expect that the licensee verify by field testing that this lighting is adequate to perform the intended tasks.

5. ALTERNATIVE AND DEDICATED SHUTDOWN CAPABILITY

5.1 Safe and Alternative Shutdown

5.1.1 Previously Accepted Alternative Shutdown Capability

QUESTION

As part of the Appendix A review process, some plants had committed to an alternative shutdown system in the form of a remote shutdown panel or remote shutdown system. Footnote 2 to Appendix R describes alternative shutdown capability as being associated with "Rerouting, relocating, or modifying of existing systems." To the extent that an existing remote shutdown system previously reviewed and approved under Appendix A to BTP 9.5-1 does not require modifications, rerouting, or relocating of existing systems, are the requirements of Section III.L of Appendix R backfit?

RESPONSE

Yes. Existing remote shutdown capabilities previously reviewed and approved under Appendix A to BTP APCSB 9.5-1 do not categorically comply with Section III.G.3 of Appendix R. Licensees were requested to re-analyze their plants to determine compliance with Section III.G. If the licensee chooses to use the

option of III.G.3 for provision of safe shutdown capability for certain areas, the criteria of Section III.L are applicable to that capability for that area. See also the response to 5.1.3.

5.1.2 Pre-Existing Alternative Shutdown Capability

QUESTIONS

Some licensees defined safe shutdown capability for purposes of analysis to Section III.G criteria as being composed of both the normal safe shutdown capability and the pre-existing redundant or remote safe shutdown capability which was previously installed as part of the Appendix A process. This definition often took the form of two "safe shutdown trains" comprising (1) one of the two normal safe shutdown trains, and (2) a second safe shutdown train ability which was being provided by the pre-existing remote shutdown capability. This definitional process, which was undertaken by a number of licensees, makes a significant difference in the implementation of Appendix R. Under such a definition, does Section III.L criteria apply when the Commission did not call out Section III.L as a backfit?

RESPONSE

The definitional process mentioned considers an alternative shutdown capability provided under the Appendix A review as a redundant shutdown capability under the Appendix R review. This definitional process is incorrect. For the purpose of analysis to Section III.G.2 criteria, the safe shutdown capability is defined as one of the two normal safe shutdown trains. If the criteria of Section III.G.2 are not met, an alternative shutdown capability is required. The alternative shutdown capability may utilize existing remote shutdown capabilities and must meet the criteria of Sections III.G.3 and III.L of Appendix R. See also the response to 5.1.3.

5.1.3 III.L Backfit

QUESTION

Why do the Staff interpretive memoranda regarding the criteria for satisfaction of Section III.L form the auditable basis for determining compliance to Appendix R when the Commission failed to backfit this section to all plants?

RESPONSE

Although 10 CFR 50.48(b) does not specifically include Section III.L with Sections III.G, J, and O of Appendix R as a requirement applicable to all power reactors licensed prior to January 1, 1979, the Appendix, read as a whole, and the Court of Appeals decision on the Appendix, Connecticut Light and Power, et al. v. NRC, 673 F2d. 525 (D.C. Cir., 1982), demonstrate that Section III.L applies to the alternative safe shutdown option under Section III.G if and where that option is chosen by the licensee. This does not preclude licensees from proposing and justifying other methods, e.g., see Section #1, Process Monitoring Instrumentation, of the "Interpretations of Appendix R."

5.2 Procedures

5.2.1 Shutdown and Repair Basis

QUESTION

With regard to the term "post-fire procedures" the Commission states that it is impossible to predict the course and extent of a fire. Given this, how does one write post-fire shutdown and repair procedures that are both symptomatic and usable to an operator?

RESPONSE

Safe shutdown capabilities including alternative shutdown capabilities are all designed for some maximum level of fire damage (system unavailabilities, spurious actuations). Since the extent of the fire cannot be predicted, it seems prudent to have the post-fire shutdown procedures guide the operator from full system availability to the minimum shutdown capability. As for repair procedure, similar conditions exist. A repair procedure can be written based on the maximum level of damage that is expected. This procedure would then provide shutdown capability without accurately predicting likely fire damage.

5.2.2 Post Fire Operating Procedures

QUESTION

Does the NRC have any requirements regarding whether post-fire operating procedures should be based upon fire areas, systems, or be symptom-based?

RESPONSE

The NRC does not have requirements, nor do we propose any requirements regarding whether post-fire operating procedures should be based upon fire areas, systems or be symptom-based. We suggest that the post-fire shutdown capabilities designs be reviewed with the plant operation staff and procedures written with their input. See also responses to 5.2.1 and 5.2.3.

5.2.3 Alternative Shutdown Capability

QUESTION

Is it acceptable to develop post-fire operating procedures only for those areas where alternative shutdown is required? (For other areas standard, emergency operating procedures would be utilized in the presence of potential fire damage to a single train.)

RESPONSE

Yes. The only requirement for post-fire operating procedures is for those areas where alternative shutdown is required. For other areas of the plant, shutdown would be achieved utilizing one of the two normal trains of shutdown system. Shutdown in degraded modes (one train unavailable) should be covered by present operator training and abnormal and emergency operating procedures. If the degraded modes of operation are not presently covered, we would suggest that the operation staff of the plant determine whether additional training or procedures are needed.

5.2.4 Post Fire Procedures Guidance Documents

QUESTION

Do any NRC Staff guidance documents exist relative to the extent, form, nature, etc. of Appendix R post-fire operating procedures?

RESPONSE

No. Other than the criteria of Section III.L, no specific post-fire shutdown procedure guidance has been developed. See also responses to 5.2.1, 5.2.2 and 5.2.3. The inspection process will be flexible in this regard as long as the licensee can show compliance with the criteria of Section III.L.

5.3 Safe Shutdown and Fire Damage

5.3.1 Circuit Failure Modes

QUESTION

What circuit failure modes must be considered in identifying circuits associated by spurious actuation?

RESPONSE

Sections III.G.2 and III.L.7 of Appendix R define the circuit failure modes as hot shorts, open circuits, and shorts to ground. For consideration of spurious actuations, all possible functional failure states must be evaluated, that is, the component could be energized or de-energized by one or more of the above failure modes. Therefore, valves could fail open or closed; pumps could fail running or not running; electrical distribution breakers could fail open or closed. For three-phase AC circuits, the probability of getting a hot short on all three phases in the proper sequence to cause spurious operation of a motor is considered sufficiently low as to not require evaluation except for any cases involving Hi/Lo pressure interfaces. For ungrounded DC circuits, if it can be shown that only two hot shorts of the proper polarity without grounding could cause spurious operation, no further evaluation is necessary except for any cases involving Hi/Lo pressure interfaces.

5.3.2 "Hot Short" Duration

QUESTION

If one mode of fire damage involves a "hot short" how long does that condition exist as a result of fire damage prior to terminating in a ground or open circuit and stopping the spurious actuation?

RESPONSE

We would postulate that a "hot short" condition exists until action has been taken to isolate the given circuit from the fire area, or other actions as

appropriate have been taken to negate the effects of the spurious actuation. We do not postulate that the fire would eventually clear the "hot short."

5.3.3 Hot Shutdown Duration

QUESTION

Since hot shutdown cannot be maintained indefinitely, hot shutdown equipment needs to be protected for only a limited period of time. How long must a plant remain in that condition in order to meet the requirement for achieving hot shutdown with a single train of equipment?

RESPONSE

Section III.G.1 requires that the one train of systems needed to achieve and maintain hot shutdown be free of fire damage. Thus, the systems needed are to be completely protected from the fire regardless of time. If the intent of the question concerns how long these systems must operate, these systems must be capable of operating until the systems needed to achieve and maintain cold shutdown are available.

5.3.4 Cooldown Equipment

QUESTION

Certain equipment is necessary only in the cooldown phase when the plant is neither in hot nor cold shutdown condition as defined by technical specifications. Is this equipment considered hot or cold shutdown in nature?

RESPONSE

As stated in Section III.G.1, one train of systems needed to achieve and maintain hot shutdown conditions must be free of fire damage. Systems necessary to achieve and maintain cold shutdown can be repaired within 72 hours. Thus, if this certain equipment necessary only in the cooldown phase, is used to achieve cold shutdown, it can be repaired within 72 hours. If the certain equipment is maintaining hot shutdown while repairs are being made, one train must be free of fire damage. See also Section #2 of the "Interpretations of Appendix R."

5.3.5 Pressurizer Heaters

QUESTION

Most PWRs do not require pressurizer heaters to maintain stable conditions. In fact, the Commission does not consider heaters to be important to safety and they are not required to meet Class IE requirements. Are they required for hot shutdown under Appendix R? If yes, then how does a plant meet the separation requirements of Section III.G.2.d,e. or f without major structural alterations to the pressurizer?

RESPONSE

One train of systems necessary to achieve and maintain hot shutdown conditions must be free of fire damage. PWR licensees have demonstrated the capability to achieve and maintain stable hot shutdown conditions without the use of pressurizer heaters by utilizing the charging pump and a water solid pressurizer for reactor coolant pressure control.

5.3.6 On-Site Power

QUESTION

Appendix R, Section III.L.4 states in part, "If such equipment and systems will not be capable of being powered by both on-site and off-site electrical power systems because of fire damage, an independent on-site power system shall be provided." Again, in Appendix R, Section III.L.5, the statement is made "If such equipment and systems used prior to 72 hours after the fire will not be capable of being powered by both onsite and offsite electrical power systems because of fire damage, an independent onsite power system shall be provided." An interpretation is needed of the meaning and the applicability of these two quotes relative to alternative shutdown capabilities.

RESPONSE

These statements are meant to indicate that the alternative shutdown capability should be powered from an onsite power system independent (both electrically and physically) from the area under consideration. Further, if the normal emergency onsite power supplies (diesel generators) are not available because of fire damage, then a separate and independent onsite power system shall be provided. As an example, some plants are utilizing a dedicated onsite diesel generator or gas turbine to power instrumentation and control panels which are a part of the alternative shutdown capability.

5.3.7 Torus Level Indication

QUESTION

For BWRs, I&E Information Notice 84-09 suggests that licensees need to have torus level indication post-fire. If an analysis shows that a level does not change significantly during any operational modes or worse case conditions, is level indication still required? Is an analysis in file adequate or is an exemption request required?

RESPONSE

It continues to be our position that torus (suppression pool) level indication is the preferred post-fire monitoring instrumentation in order to confirm the availability of the torus (suppression pool) as a heat sink. We recognize that existing analyses indicate that suppression pool level is not significantly changed during emergency shutdown conditions. However, we believe the operator should be able to confirm that spurious operations or other unanticipated occurrences have not affected the torus function. An analysis of torus level change by itself is not considered an acceptable basis.

5.3.8 Short Circuit Coordination Studies

QUESTION

Should circuit coordination studies consider high impedance faults?

RESPONSE

To meet the separation criteria of Section III.G.2 and III.G.3 of Appendix R, high impedance faults should be considered for all associated circuits located in the fire area of concern. Thus, simultaneous high impedance faults (below the trip point for the breaker on each individual circuit) for all associated circuits located in the fire area should be considered in the evaluation of the safe shutdown capability. Clearing such faults on associated circuits which may affect safe shutdown may be accomplished by manual breaker trips governed by written procedures. Circuit coordination studies need not be performed if it is assumed that shutdown capability will be disabled by such high impedance faults and appropriate written procedures for clearing them are provided.

5.3.9 Diagnostic Instrumentation

QUESTION

What is diagnostic instrumentation?

RESPONSE

Diagnostic instrumentation is instrumentation, beyond that previously identified in Attachment 1 to I&E Information Notice 84-09, needed to assure proper actuation and functioning of safe shutdown equipment and support equipment (e.g., flow rate, pump discharge pressure). The diagnostic instrumentation needed depends on the design of the alternative shutdown capability. Diagnostic instrumentation, if needed, will be evaluated during the staff's review of the licensee's proposal for the alternative shutdown capability.

5.3.10 Design Basis Plant Transients

QUESTION

What plant transients should be considered in the design of the alternative or dedicated shutdown systems?

RESPONSE

Per the criteria of Section III.L of Appendix R a loss of offsite power shall be assumed for a fire in any fire area concurrent with the following assumptions:

a. The safe shutdown capability should not be adversely affected by any one spurious actuation or signal resulting from a fire in any plant area; and

b. The safe shutdown capability should not be adversely affected by a fire in any plant area which results in the loss of all automatic function (signals, logic) from the circuits located in the area in conjunction with one worst case spurious actuation or signal resulting from the fire; and

c. The safe shutdown capability should not be adversely affected by a fire in any plant area which results in spurious actuation of the redundant valves in any one high-low pressure interface line.

5.3.11 Alternative/Dedicated Shutdown v. Remote Shutdown Systems

QUESTION

What is the difference between the alternate/dedicated shutdown systems required for fire protection and the remote shutdown systems recommended under Chapter 7 of the SRP?

RESPONSE

The remote shutdown systems recommended under Chapter 7 of the SRP are needed to meet GDC 19. These remote shutdown systems need to be redundant and physically independent of the control room in order to meet GDC 19. For GDC 19, damage to the control room is not considered. Alternate shutdown systems for Appendix R need not be redundant but must be both physically and electrically independent of the control room.

6. OIL COLLECTION SYSTEMS FOR REACTOR COOLANT PUMP

6.1 Lube Oil System Seismic Design

QUESTION

If the reactor coolant pump lube oil system and associated appurtenances are seismically designed, does the lube oil collection system also require seismic design? Is an exemption required?

RESPONSE

Where the RCP lube oil system is capable of withstanding the safe shutdown earthquake (SSE), the analysis should assume that only random oil leaks from the joints could occur during the lifetime of the plant. The oil collection system, therefore, should be designed to safely channel the quantity of oil from one pump to a vented closed container. Under this set of circumstances, the oil collection system would not have to be seismically designed.

An exemption is required for a non-seismically designed oil collection system. The basis for this exemption would be that random leaks are not. assumed to occur simultaneously with the seismic event, since the lube oil system is designed to withstand the seismic event. However, the Rule, as written, does not make this allowance.

6.2 Container

QUESTION

It would appear that a literal reading of Section III.O regarding the oil collection system for the reactor coolant pump could be met by a combination of seismically designed splash shields and a sump with sufficient capacity to contain the entire lube oil system inventory. If the reactor coolant pump is seismically designed and the nearby piping hot surfaces are protected by seismically designed splash shields such that any spilled lube oil would contact only cold surfaces, does this design concept conform to the requirements of the rule?

RESPONSE

If the reactor coolant pump, including the oil system, is seismically designed and the nearby hot surfaces of piping are protected by seismically designed splash shields such that any spilled lube oil would contact only cold surfaces, and it could be demonstrated by engineering analysis that sump and splash shields would be capable of preventing a fire during normal and design basis accident conditions, the safety objective of Section III.O would be achieved. Such a design concept would have to be evaluated under the exemption process. The justification for the exemption should provide reasonable assurance that oil from all potential pressurized and unpressurized leakage points would be safely collected and drained to the sump. The sump should be shown capable of safely containing all of the anticipated oil leakage. The analysis should verify that there are no electric sources of ignition.

7 BRANCH TECHNICAL POSITION CMEB 9.5-1

7.1 Fire Protection and Seismic Events

QUESTION

For which situations other than the reactor coolant pump lube oil system are seismic events assumed to be initiators of a fire?

RESPONSE

The guidelines for the seismic design of fire protection systems which cover other general situations is delineated in BTP CMEB 9.5-1 C.1.C(3) and (4):

"(3) As a minimum, the fire suppression system should be capable of delivering water to manual hose stations located within hose reach of areas containing equipment required for safe plant shutdown following the safe shutdown earthquake (SSE). In areas of high seismic activity, the staff will consider on a case-by-case basis the need to design the fire detection and suppression systems to be functional following the SSE.

(4) The fire protection systems should retain their original design capability for (a) natural phenomena of less severity and greater frequency than the most severe natural phenomena (approximately once in 10 years) such as tornadoes, hurricanes, floods, ice storms, or small intensity earthquakes

that are characteristic of the geographic region, and (b) potential man-made site related events such as oil barge collisions or aircraft crashes that have a reasonable probability of occurring at a specific plant site. The effects of lightning strikes should be included in the overall plant fire protection program:"

We have considered California as being a high seismic activity area.

For those plants reviewed under Appendix A, our position is (A.4):

"Postulated fires or fire protection system failures need not be considered concurrent with other plant accidents or the most severe natural phenomena."

Our guidelines on the seismic design of fire protection systems installed in safety related areas are delineated in Regulatory Guide 1.29 "Seismic Design Classification," paragraph C.2. The failure of any system should not affect a system from performing its safety function.

Our guidelines on the seismic design of hydrogen lines is delineated in BTP CMEB 9.5-1 Section C.5.d(5):

(5) Hydrogen lines in safety-related areas should be either designed to seismic Class I requirements, or sleeved such that the outer pipe is directly vented to the outside, or should be equipped with excess flow valves so that in case of a line break, the hydrogen concentration in the affected areas will not exceed 2%.

All PWR's have a hydrogen line going to the Volume Control Tank (Make-up

Tank) that needs to be protected.

To identify plant specific situations in which seismic events could initiate a fire in a specific plant area, the fire protection engineer and systems engineer performing the fire hazards analysis should be concerned with in-situ combustible materials which can be released in a manner such that they could contact in-situ ignition sources by a seismic event. An example of this would be the rupture of the RCP lube oil line directly above the hot reactor coolant piping. The fire protection engineer should also be concerned with seismic induced ignition sources, electrical or mechanical, which could contact nearby in-situ combustible materials. It should be noted that the guidelines cited above from BTP CMEB 9.5-1 are not applicable to plants reviewed and approved under BTP APCSB 9.5-1.

7.2 Random Fire and Seismic Events

QUESTION

Is a random fire to be postulated concurrent with a seismic event?

RESPONSE

Our position, as stated in Section C.1.6 of BTP CMEB 9.5-1, is "Worst case fire need not be postulated to be simultaneous with non-fire related failures in safety systems, plant accidents, or the most severe natural phenomena."

Where plant systems are designed to prevent the release of combustible materials caused by a seismic event, such as a dike around a fuel oil tank transformer, or seismic supports for hydrogen lines, then no fire need to be arbitrarily assumed to take place in the fire hazards analysis.

Because it is impossible to completely preclude the occurrence of a seismically induced fire, Section C.6.c(4) of CMEB 9.5-1 states:

"Provisions should be made to supply water at least to standpipes and hose connections for manual fire fighting in areas containing equipment required for safe plant shutdown in the event of a safe shutdown earthquake. The piping system serving such hose stations should be analyzed for SSE loading and should be provided with supports to ensure system pressure integrity. The piping and valves for the portion of hose standpipe system affected by this functional requirement should, as a minimum, satisfy ANSI B31.1, 'Power Piping.' The water supply for this condition may be obtained by manual operator actuation of valves in a connection to the hose standpipe header from a normal seismic Category I water system such as the essential service water system. The cross connection should be (a) capable of providing flow to at least two hose stations (approximately 75 gpm per hose station), and (b) designed to the same standards as the seismic Category I water system; it should not degrade the performance of the seismic Category I water system."

The post-seismic procedures should include a damage survey, and a determination of whether any fires were initiated as a result of the seismic event. See also the response to Question 7.1.
It should be noted that the guidelines cited above from BTP CMEB 9.5-1 are not applicable to plants reviewed and approved under BTP APCSB 9.5-1.

8. LICENSING POLICY

8.1 Fire Hazard Analysis/Fire Protection Plan Updating

QUESTION

What constitutes the fire protection plan required by 50.48(a)? Should licensees have programs to maintain the fire hazards analysis and the fire protection plan current or updated periodically? How often should the plan be updated? Must revisions be provided to the NRC?

RESPONSE

The basic elements required in the fire protection plan are described in 10 CFR 50.48(a). The fire protection program that implements that plan should include the details of the fire hazards analysis. The plan and program may be separate or combined documents and must be kept current with the fire hazards analysis updated prior to making modifications. We would expect that the fire protection plan and program will be incorporated as part of the FSAR and therefore, would be updated and submitted to the NRC in conformance with the requirements of 10 CFR 50.71(e).

8.2 Fire Protection License Condition

QUESTION

What is the significance of the fire protection license condition?

RESPONSE

See Generic Letter Section F

8.3 III G, J and O Exemptions for Future Modifications

QUESTION

Is an exemption required from Appendix R Sections other than III.G, III.J and III.O for future modifications that do not comply with such sections?

RESPONSE

Yes, for plants licensed prior to January 1, 1979 and for those modifications which deviate from the previously accepted fire protection configurations. The exclusion of the applicability of Sections of Appendix R other than III.G, III.J, and III.O is limited to those features "accepted by the NRC staff as satisfying the provisions of Appendix A to Branch Technical Position BTP APCSB 9.5-1 reflected in staff fire protection safety evaluation reports issued prior to the effective date of the rule." No reanalysis is required except for proposed modifications which would alter previously approved features. This position is based directly on CFR 50.48(b). Also see response to Question 8.1.

8.4 Future Changes

QUESTION

Will future changes (no matter how minor) to approved configurations be required to be reviewed by the Staff in an exemption request? At what point may the process of 10 CFR 50.59 be invoked?

RESPONSE

If a future modification involves a change to a license condition or technical specification, a license amendment request must be submitted. When a modification not involving a technical specification or license condition is planned,

the evaluation made in conformance with 10 CFR 50.59 to determine whether an unreviewed safety question is involved must include an assessment of the modification's impact on the existing fire hazards analysis for the area. This part of the evaluation must be performed by the person responsible for the fire safety program for the plant. The assessment must include the effect on combustible loading and distribution and the consideration of whether circuits or components, including associated circuits, for a train of equipment needed for safe shutdown are being affected or a new element introduced in the area. If this evaluation concludes that there is no significant impact, this conclusion and its basis must be documented as part of the 50.59 evaluation and be available for future inspection and reference. If the evaluation finds that there is an impact that could result in the area either not being in conformance with Appendix R, or some other aspect of the approved fire protection program, or being outside the basis for an exemption that was granted for the area involved, the licensee must either make modifications to achieve conformance or justify and request exemption (or, for the post 1979 plants, approval) from the NRC. See also responses to Questions 8.1 and 8.2.

8.5 Schedular and Blanket Exemptions

QUESTION

If an exemption is warranted and at the same time the provisions of the rule indicate that the appropriate schedular deadlines have passed, should a schedular exemption be filed at the same time as the technical exemption request?

If as part of the exemption request the utility is proposing to make modifications to achieve a reasonable level of conformance with Appendix R, and if the associated "clock" has run out for that type of modification, should the technical exemption request and the description of the modification be filed with a schedular exemption?

When filing a schedular exemption under 50.12, it is not always clear from what specific paragraphs of 50.48 an exemption should be sought. Is it acceptable to request a blanket exemption from the schedular provisions of 10 CFR 50.48 without a specification by paragraph?

If an exemption request is submitted to meet newly published interpretations of Appendix R, when does the licensee need to be in compliance? Is the schedule presented in Appendix R still the guideline or must a new schedule be developed under a different criteria?

RESPONSE

In response to the first two questions above, once the time period allowed by a schedule in 50.48 has run out, the schedule cannot be reinstituted by exemption. In such a situation the licensee is in violation of the regulation and should notify the Region proposing compensatory measures and a schedule for gaining compliance either with the provisions of Appendix R or with the provisions of an approved technical exemption. If a technical exemption is involved but is not yet applied for, the schedule for that action should be included and the licensee runs the risk that if the technical exemption is denied, a violation of the regulation has been incurred.

Requests for schedular exemptions may be made under 10 CFR 50.12, but such requests will be granted sparingly based upon the following criteria:

1. The utility has, since the promulgation of Appendix R in 1980, proceeded expeditiously to meet the Commission's requirements.

2. The delay is caused by circumstances beyond the utility's control, or immediate implementation would cause undue hardship (e.g., plant shut-down to effect a minor modification).

3. The proposed schedule for completion represents a best effort under the circumstances.

4. Adequate interim compensatory measures will be taken until compliance is achieved.

This policy is further explained in the generic letter transmitting this package.

8.6 Trivial Deviations

QUESTION

What guidance can the NRC Staff give the industry regarding when a deviation from the literal interpretation of Appendix R is sufficiently trivial as to not require a specific exemption?

RESPONSE

The significance of a deviation must be judged as part of a fire hazards analysis. The conclusion of this analysis is always subject to review by the NRC inspector.

8.7 Revised Modifications

QUESTION

What is the process for altering configurations not yet implemented for plants with Appendix R SERs?

RESPONSE

If licensees propose changes to their NRC approved modifications, they must submit their new proposal and revised schedule for implementation for NRC approval.

This change must be justified as to (1) the reason for the change, (2) the basis for the revised schedule, and (3) the interim measures that will be provided to assure post fire shutdown capability until the final modifications are implemented. Whether or not enforcement action will be taken based upon continued noncompliance with Appendix R will be decided by the NRC Regional Administrator in consultation with NRC Headquarters.

8.8 Smallest Opening in a Fire Barrier

QUESTION

What is the smallest opening allowed in a fire area barrier for which an exemption request is not needed?

RESPONSE

Unsealed openings in the configuration for which approval was obtained by an approved laboratory or the NRC staff would be acceptable.

Our position on openings is given in Section 5.a(3) of BTP CMEB 9.5-1:

"(3) Openings through fire barriers for pipe, conduit, and cable trays which separate fire areas should be sealed or closed to provide a fire resistance rating at least equal to that required of the barrier Itself. Openings inside conduit larger than 4 inches in diameter should be sealed at the fire barrier penetration. Openings inside conduit 4 inches or less in diameter should be sealed on each side of the fire barrier and sealed either at both ends or at the fire barrier with non-combustible material to prevent the passage of smoke and hot gases. Fire barrier penetrations that must maintain environmental isolation or pressure differentials should be qualified by test to maintain the barrier integrity under such conditions."

The unsealed opening(s) allowed in a fire area boundary or a barrier which separates redundant shutdown divisions should not permit flame, radiant energy, smoke and hot gases to pass through the barrier and cause damage to redundant shutdown divisions on the other side. The licensee should assess the adequacy of existing protection and should determine the minimum size based on a fire hazards analysis and conservative fire protection engineering judgment. If the significance of openings in fire barriers is marginal, a formal exemption request could be submitted or the staff consulted. The basis for the lack of significance should be available for review by NRC Inspectors.

Our acceptance of unprotected openings in fire barriers would depend upon the quantity and nature of combustible materials on either side of the barrier; the location of the opening(s) in relation to the ceiling (for openings in walls); the location, vulnerability and importance of shutdown systems on either side of the barrier; and compensating fire protection.

See also Section #4 of the "Interpretations of Appendix R."

8.9 NFPA Code Deviation

QUESTION

Is an exemption/deviation required for deviations from NFPA Codes?

RESPONSE

Deviations from the codes should be identified and justified in the FSAR or FHA.

An exemption is not required for NFPA codes. NRC guidelines reference certain NFPA codes as guidelines to the systems acceptable to the staff, and therefore such codes may be accorded the same status as Regulatory Guides.

When the applicant/licensee states that its design "meets the NFPA codes" or, "meets the Intent of the NFPA Codes" and does not identify any deviations from such codes, NRR and the Regions expect that the design conforms to the code and the design is subject to inspection against the NFPA codes.

8.10 "ASTM E-119" Design Basis

QUESTION

Is an exemption/deviation required, if components are designed to withstand an "ASTM E-119" fire?

RESPONSE

Some cables are being developed for high temperature (e.g., 1700 F) applications. An exemption would be required if such cable is used in lieu of the alternatives of III.G.2 or III.G.3 in a pre-1979 plant. A deviation from the guidelines would be required for similar applications in a post 1979 plant.

8.11 Plants Licensed After January 1, 1979

QUESTION

What fire protection guidelines and requirements apply to the plants licensed after January 1, 1979?

RESPONSE

Post-1979 plants are subject to:

o GDC 3

o 10 CFR 50.48(a) and (e)

o The guidelines identified in the footnotes to 50.48(a)

o Guidelines documents issued after January 1, 1979.

o Commitments made to meet the requirements of Appendix R; or specific sections such as III.G, III.J, III.O; and Appendix A to BTP APCSB 9.5-1; or BTP CMEB 9.5-1, which includes the requirements of Appendix R* and the previous guidance documents incorporated into the Branch Technical Position.

The license for each plant licensed after January 1, 1979 contains a license condition which identifies by reference the approved fire protection program for that plant.

* A deficiency in the BTP CMEB 9.5-1 has been noted in that a requirement in Appendix R Section III.G.3.b to provide alternative or dedicated shutdown capability in an area where both redundant safe shutdown trains could be damaged

by suppression activities or inadvertent operation or rupture of fire suppression systems is not included. This requirement will be added in the next revision of the BTP.

8.12 Cold Shutdown Equipment Availability

QUESTION

A. Can a licensee achieve compliance with III.G.1(b) by demonstrating that one train of cold shutdown equipment will remain free of fire damage?

B. In demonstrating that one train of cold shutdown equipment will remain free of fire damage, is a licensee limited to the three alternatives in III.G.2?

RESPONSE

A. Yes.
B. No.

8.13 Guidance Documents

QUESTION

Please list all NRR guidance documents and position papers issued since Appendix R was promulgated.

RESPONSE

Fire Protection Guidance Issued Since January 1, 1975:

IE Information Notices

No. 83-41: Actuation of fire suppression systems causing inoperability of safety related equipment.

No. 83-69: Improperly installed fire dampers at nuclear power plants.

No. 83-83: Use of portable radio transmitters inside nuclear power plants.

*No. 84-09: Lessons Learned From NRC Inspections of Fire Protection Safe Shutdown Systems (10 CFR 50, Appendix R)

Standard Review Plan

9.5.1, Rev. 1 Fire Protection System, dated 5/1/76
9.5.1, Rev. 2 Fire Protection Program, dated 03/78
9.5.1, Rev. 3 Fire Protection Program, July 1981.

Regulations

10 CFR Part 50: Proposed fire protection program for nuclear power plants operating prior to January 1, 1979, dated May 29, 1980. Federal Register Vol. 45, No. 105, 36082.

10 CFR Part 50: Fire protection program for operating nuclear power plants, dated November 19, 1980. Federal Register Vol. 45, No. 225, 76602.

10 CFR Part 50: Fire protection rule corrections, dated September 8, 1981. Federal Register Vol. 46, No. 173, 44734.

Generic Letters

NOTE: The following documents were obtained from the Palisades file Docket No. 50-255. Similar documents should be in the file for other operating facilities. The dates may vary slightly.

1. Letter dated 9/28/76 - Enclosing App. A to BTP APCSB 9.5-1 and supplementary guidance on information needed for fire protection program evaluation.

2. Letter dated 12/1/76 - Enclosing sample Technical Specifications and an errata sheet.

3. Letter dated 8/19/77 - Enclosing "Nuclear Plant Fire Protection Functional Responsibilities, Administrative Controls and Quality Assurance."

4. Letter dated 6/8/78 - Re: Manpower requirements for operating reactors.

5. Letter dated 9!7/79 - Re: Minimum fire brigade shift size.

6. Letter dated 9/14/79 - Enclosing staff positions - safe shutdown capability.

7. Letter dated 10/31/80 - Enclosing new 10 CFR 50.48 regarding fire protection schedules for operating nuclear power plants.

8. Letter dated 11/24/80 - Enclosing a copy of revised 10 CFR 50.48 and new App. R to 10 CFR 50, and a summary of open items from the SER for the BTP APCSB 9.5-1 review.

9. Letter dated 2/20/81 - Generic Letter 81-12 identifying information needed for NRC review of modifications for alternative shutdown capability.

10. Letter dated 4/7/82 - Provided clarification to Generic Letter 81-12 and guidance on information needed for NRC review of exemption requests.

11. Letter dated 10/6/82 - Generic Letter 82-21; provided criteria for annual, biennial, and triennial audits required by Technical Specifications.

*12. Letter dated 10/19/83 - Generic Letter 83-33; NRC Positions on Certain Requirements of Appendix R to 10 CFR 50.

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Staff Generic Positions

1. Letter, Denton to Bernsen, dated 4/20/82 - Control room fires.

*2. SECY 83-269, dated July 5, 1983 - Attachments B and C.

3. Memo, Eisenhut to Olshinski, dated 12/30/83 - Physical independence of electrical systems.

4. Memo, Eisenhut to Jordan, dated 10/24/83 - Bullet resistant fire doors.

*Staff positions regarding the need for certain exemptions delineated in this guidance document have been revised per the "Interpretations of Appendix R".

8.14 Deviation From Guidance Documents

QUESTION

If a utility determines that a deviation from a guidance document exists, does an exemption request need to be filed? If so, what is the legal basis for this requirement?

RESPONSE

No.

8.15 Staff Interpretation of Appendix R

QUESTION

How does the Staff initiate interpretations of Appendix R in a manner which ensures their technical adequacy and consistency with the rule's objectives (e.g., presentation to ACRS, issue for comment as in draft regulatory guides, etc.)?

RESPONSE

Staff positions are initiated when our experience shows that generic issues are identified that require clarification. These positions are reviewed for accuracy and consistency by the cognizant Division Directors. Usually, they are not issued for comment. However, Generic Letter 83-33 was commented on by the NUFPG since it was initiated, in part, at their request.

8.16 Dissemination of New Staff Positions

QUESTION

Will licensees be automatically sent a copy of new Staff position papers as they are developed?

RESPONSE

The Staff positions on generic subjects are considered for issuance in Generic Letters from ONRR and Information Notices or Bulletins from OI&E. Staff

positions issued for specific questions on specific plants are not given generic promulgation because they normally involve plant specific design considerations.

8.17 Equivalent Alternatives

QUESTION

How does a licensee demonstrate that alternative measures are equivalent to the measures of Section III.G.2 in order to obtain an exemption lacking a formal definition of the term "free of fire damage"?

RESPONSE

See Item #3 of "Interpretations of Appendix R."

8.18 Coordination Study Update

QUESTION

Circuit modifications are an ongoing process. How recent must a coordination study be in order to be valid in protecting circuits associated by common power source?

RESPONSE

We would expect that as circuit modifications are made, the design package would address the electrical protection required and the effects of this protection on the coordination of the protection for the power distribution system. This type of consideration should be included in the evaluation required by 10 CFR 50.59 Changes, Tests and Experiments. The design package and modification evaluation could not be complete without consideration of the coordination study. Therefore, we would expect that the coordination studies would be current with the last circuit modification made.

8.19 Exemption Request Threshold

QUESTION

(a) What is the threshold for exemption requests? (b) Is it necessary to file a request for each and every possible deviation from Appendix R?

RESPONSE

Typical examples are discussed in the response to Questions 8.19.1 through 8.19.4.

(a) The licensee must develop its criteria for an exemption request threshold.

(b) No.

8.19.1 Penetration Designs Not Laboratory Approved

QUESTION

Where penetration designs have been reviewed and approved by NRC but have not been classified by an approval laboratory, will it be necessary to submit an exemption request?

RESPONSE

No.

8.19.2 Individual vs. Package Exemptions

QUESTION

How do we submit future modification exemption requests, etc.? Would NRC prefer them individually, or developed and submitted in packages for review and approval?

RESPONSE

Future exemptions should be submitted individually, if they are independent of each other.

8.19.3 Exemption Request Supporting Detail

QUESTION

When an exemption request is filed, what criteria are used to determine the level of detail needed to support the request?

RESPONSE

See Enclosure 2 of NRC's letter to all licensees dated April-May 1982.

8.19.4 50.12 vs. 50.48 Exemption Requests

QUESTION

With regard to exemption requests for future modifications, will they be submitted under 50.12 or 50.48?

RESPONSE

10 CFR 50.12.

8.20 Post January 1, 1979 Plants and Exemption Requests

QUESTION

Do plants licensed after January 1, 1979 which have committed to meet the requirements of Section III.G, III.J and III.O and are required to do so as a license condition, need to request exemptions for alternative configurations?

RESPONSE

No; however, deviations from the requirements of Section III.G, III.J and III.O should be identified and justified in the FSAR or FHA and the deviation would probably require a license amendment to change the license condition. See responses 8.1 and 8.2.

8.21 NRC Approval for BTP CMEB 9.5-1 Deviations

QUESTION

Do future deviations from BTP CMEB 9.5-1 guidelines require approval by the NRC? Do such deviations constitute a violation of license conditions?

RESPONSE

Compliance with guidelines in the BTP is only required to the extent that they were incorporated in the approved Fire Protection Program as identified in the license condition. (See Response 8.2)

9. INSPECTION POLICY

9.1 Safety Implications

QUESTION

Since the Commission states that fire damage cannot be defined and fire spread cannot be predicted, how does the Commission determine which Appendix R violations have "important safety implications?"

RESPONSE

III.G.2 provides alternatives to ensure that one of the redundant trains is free of fire damage. Fire spread within one area cannot be predicted, but damage is limited to one fire area.

Determination of the Appendix R violations that have "important safety implications" are based on the equipment, components, and systems that are located in the same fire area that are needed for safe shutdown or can adversely affect safe shutdown, and are not protected by the features of III.G.2, III.G.3 or an approved alternative.

9.2 Uniform Enforcement

QUESTION

How does the Commission ensure that violations of the rule are uniformly treated between regions?

RESPONSE

Each Region evaluates violations in accordance with the NRC Enforcement Policy, 10 CFR 2, Appendix C. The Policy provides guidance for the determination of appropriate enforcement sanctions for violations. The Office of Inspection and Enforcement provides guidance for and monitors Regional implementation of the Policy to ensure a uniform application. In addition, the policy requires that all escalated enforcement actions be approved by the Director of the Office of Inspection and Enforcement.

9.3 NTOL Inspections

QUESTION

Will NTOLs be subject to an Appendix R audit now being performed on plants licensed to operate prior to January 1, 1979? Or, will the current review and analysis being performed by the Staff be satisfactory?

RESPONSE

Yes, NTOLs will be subject to the Appendix R audit; the TI 2515/62 is being revised to reflect the appropriate requirements for NTOLs' and it is our intent to conduct such inspections prior to issuing the operating license.

10 CFR 50.48 requires each such plant to have a fire protection plan. Their operating license will contain a specific license condition to implement their approved fire protection program which must identify deviations from Appendix R. The fire protection inspections will be against the particular license conditions.

9.4 Future TI 2515/62 Revisions

QUESTION

Does the NRC plan to issue a new or revised version of Temporary Instruction 2515/62 for future Appendix R audits?

RESPONSE

Yes.

9.5 Documentation Supplied by Licensee

QUESTION

Temporary Instruction 2515/62 provided a list of documentation that the NRC needs to review as part of the audit process. In past audits, the NRC has requested additional information other than that contained on the list. Will a new list of documentation be developed?

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RESPONSE

The documentation listing provided in TI-2515/62 does not restrict the inspection team from enhancing inspection efficiency by requesting a licensee to provide additional relevant documentation. A new listing of documentation for TI-2515/62 is not being developed.

9.6 Subsequent Inspections

QUESTION

To what extent will Appendix R issues be raised at future Regional I&E Fire Protection Audits after a successful Appendix R audit? For example, if an area has already been reviewed and no noncompliance found, will it be subject to later review and reinterpretation by the Staff?

RESPONSE

The Appendix R inspections are conducted on a sample basis. These inspections do not certify that all possible items of noncompliance with Appendix R have been identified. The inspection results do provide a basis for a determination of the adequacy of a licensee's Appendix R reanalysis, modification and preparation.

When a noncompliance with Appendix R requirements is identified, a notice of violation will be issued to ensure adequate corrective action. In those cases in which the licensee believes that the staff has invoked a reinterpretation of adequacy in areas which had previously been reviewed, NRC's procedures for appeal would be applicable.

9.7 NRC List of Conforming Items

QUESTION

At the end of the audit, will the NRC provide a list of items that had been reviewed and found in conformance with Appendix R? To date, only areas of nonconformance have been specifically identified in exit interviews.

RESPONSE

Subsequent to an Appendix R inspection, the NRC will not provide a list of items reviewed and found to be in conformance with Appendix R.

We do list the areas inspected and where non-compliances were not found.

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9.8 Inspection Re-review

QUESTION

Where assumptions are made and clearly stated within the analysis submitted to NRR for review, will such assumptions be subject to a second review by OI&E during the inspection process?

Where assumptions are made in conjunction with the analysis, should exemption requests be filed just to provide protection for the licensee?

If NRR accepts a licensee's selection of equipment and shutdown paths as being sufficient to meet the Appendix R shutdown criteria, will OI&E review and have the right to challenge the approved shutdown paths and approved equipment selection? Or will they only check the shutdown paths and equipment in question to see that they meet the Appendix R requirements, i.e., separation?

RESPONSE

To the extent that a licensee's submittal to NRR is comprehensive and sufficiently detailed, the basis for the OI&E Appendix R inspection will be the assumptions, shutdown paths and equipment selections approved by NRR. If the inspection results in new information that casts doubt upon the approved configuration, the Regional inspectors have the responsibility to resolve such doubts.

9.9 List of Shutdown Equipment

QUESTION

What lists of shutdown equipment will be used by the Regional inspectors, if the shutdown analysis has not been reviewed and approved by NRR?

RESPONSE

Regional Inspectors will use the lists of shutdown equipment the licensee has identified in his fire protection plan.

Generic Letter 81-12 and its clarification documents expect licensees to show how they will shutdown if a fire area is not provided with redundant train separation. Inherent within this expectation is the assumption that the licensee will identify the equipment to be used. It is because the licensees have not had fire hazard analyses at all for non-alternative shutdown fire areas that the inspectors to date have resorted to using the only lists available (the alternative shutdown equipment list used by NRR in their reviews).

It is unlikely there would not be a list of at least those systems to be used for alternate shutdown, since 10 CFR 50.48 requires NRR review and approval of the means of alternate shutdown.

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Fire Protection

(Name of licensee) shall implement and maintain in effect all provisions of the approved fire protection program as described in the Final Safety Analysis Report for the facility (or as described in submittals dated ____________) and as approved In the SER dated__________(and Supplements dated________________) subject to the following provision:

The licensee may make changes to the approved fire protection program without prior approval of the Commission only if those changes would not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire.

GL 81-12 CLARIFICATION

The last option as defined by Section III.G.3 provides an alternative shutdown capability to the redundant trains damaged by a fire.

4. Alternative shutdown equipment must be independent of the cables, equipment and associated circuits of the redundant systems damaged by the fire.

Associated Circuits of Concern

The following discussion provides A) a definition of associated circuits for Appendix R consideration, B) the guidelines for protecting the safe shutdown capability from the fire-induced failures of associated circuits and C) the information required by the staff to review associated circuits. The definition of associated circuits has not changed from the February 20, 1981 generic letter; but is merely clarified. It is important to note that our interest is only with those circuit (cables) whose fire-induced failure could effect shutdown. The guidelines for protecting the safe shutdown capability from the fire-induced failures of associated circuits are not requirements. These guidelines should be used only as guidance when needed. These guidelines do not limit the alternatives available to the licensee for protecting the shutdown capability. All proposed methods for protection of the shutdown capability from fire-induced failures will be evaluated by the staff for acceptability.

A. Our concern is that circuits within the fire area will receive fire damage which can affect shutdown capability and thereby prevent post-fire safe shutdown. Associated Circuits* of Concern are defined as those cables (safety related, non-safety related, Class 1E, and non-Class 1E) that:

*The definition for associated circuits is not exactly the same as the definition presented in IEEE-384-1977.

1. Have a physical separation less than that required by Section III.G.2 of Appendix R, and;

2. Have one of the following:

   a. a common power source with the shutdown equipment (redundant or alternative) and the power source is not electrically protected from the circuit of concern by coordinated breakers, fuses, or similar devices (see diagram 2a), or

   b. a connection to circuits of equipment whose spurious operation would adversely affect the shutdown capability (e.g., RHR/RCS isolation valves, ADS valves, PORVs, steam generator atmospheric dump valves, instrumentation, steam bypass, etc.) (see diagram 2b), or

   c. a common enclosure (e.g., raceway, panel, junction) with the shutdown cables (redundant and alternative) and,

      (1) are not electrically protected by circuit breakers, fuses or similar devices, or

      (2) will allow propagation of the fire into the common enclosure, (see diagram 2c).

EXAMPLES OF ASSOCIATED CIRCUITS OF CONCERN

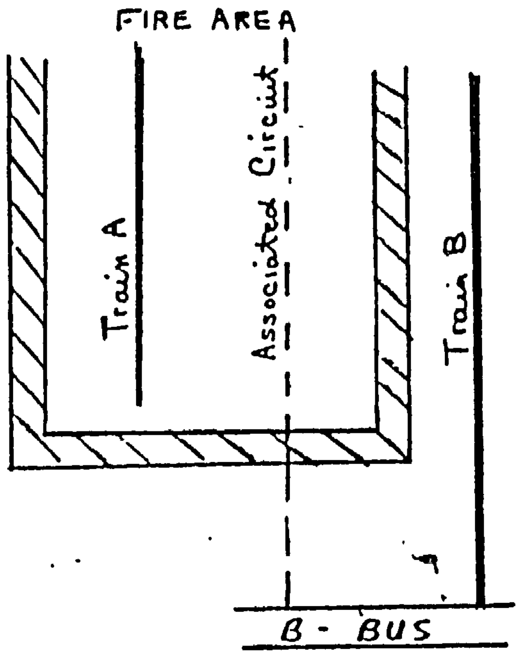


Diagram 2A

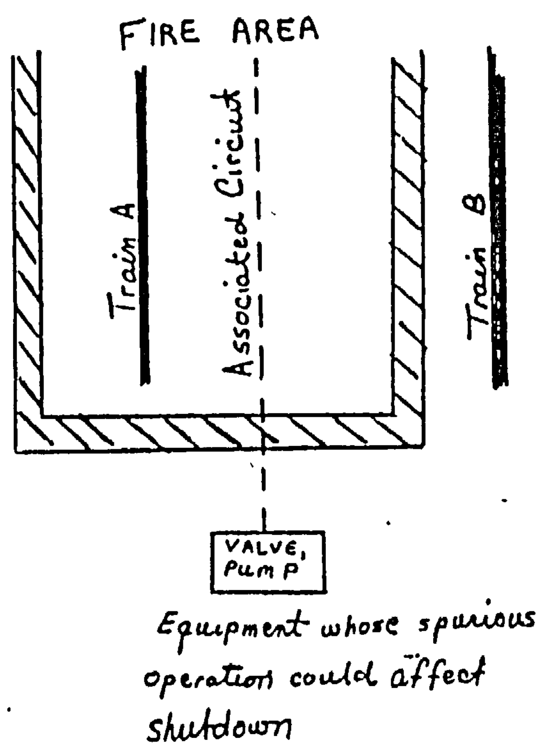
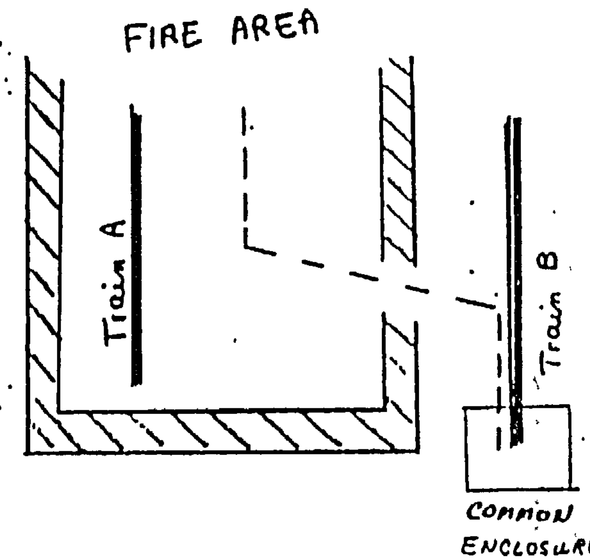


Diagram 2B



The area barriers shown above meet the appropriate sub-paragraphs (a-f) of section III.G-2 of Appendix R.

Diagram 2C

B. The following guidelines are for protecting the shutdown capability from fire-induced failures of circuits (cables) in the fire area. The guidance provided below for interrupting devices applies only to new devices installed to provide electrical isolation of associated circuits of concern, or as part of the alternative or dedicated shutdown system. The shutdown capability may be protected from the adverse effect of damage to associated circuits of concern by the following methods:

1. Provide protection between the associated circuits of concern and the shutdown circuits as per Section III.G.2 of Appendix R, or

2. a. For a common power source case of associated circuit:

Provide load fuse/breaker (interrupting devices) to feeder fuse/breaker coordination to prevent loss of the redundant or alternative shutdown power source. To ensure that the following coordination criteria are met the following should apply:

(1) The associated circuit of concern interrupting devices (breakers or fuses) time-overcurrent trip characteristic for all circuits faults should cause the interrupting device to interrupt the fault current prior to initiation of a trip of any upstream interrupting device which will cause a loss of the common power source,

(2) The power source shall supply the necessary fault current for sufficient time to ensure the proper coordination without loss of function of the shutdown loads.

The acceptability of a particular interrupting device is considered demonstrated if the following criteria are met:

(i) The interrupting device design shall be factory tested to verify overcurrent protection as designed in accordance with the applicable UL, ANSI, or NEMA standards.

(ii) For low and medium voltage switchgear (480 V and above) circuit breaker/protective relay periodic testing shall demonstrate that the overall coordination scheme remains within the limits specified in the design criteria. This testing may be performed as a series of overlapping tests.

(iii) Molded case circuit breakers shall peridically be manually exercised and inspected to insure ease of operation. On a rotating refueling outage basis a sample of these breakers shall be tested to determine that breaker drift is within that allowed by the design criteria. Breakers should be tested in accordance with an accepted QC testing methodology such as MIL STD 10 5 D.

(iv) Fuses when used as interrupting devices do not require periodic testing, due to their stability, lack of drift, and high reliability. Administrative controls must insure that replacement fuses with ratings other than those selected for proper coordinating are not accidentally used.

b. For circuits of equipment and/or components whose spurious operation would affect the capability to safely shutdown:

(1) provide a means to isolate the equipment and/or components from the fire area prior to the fire (i.e., remove power cables, open circuit breakers); or

(2) provide electrical isolation that prevents spurious operation. Potential isolation devices include breakers, fuses, amplifiers, control switches, current XFRS, fiber optic couplers, relays and transducers; or

(3) provide a means to detect spurious operations and then procedures to defeat the maloperation of equipment (i.e., closure of the block valve if PORV spuriously operates, opening of the breakers to remove spurious operation of safety injection);

c. For common enclosure cases of associated circuits:

(1) provide appropriate measures to prevent propagation of the fire; and

(2) provide electrical protection (i.e., breakers, fuses or similar devices)

C. We recognize that there are different approaches which may be used to reach the same objective of determining the interaction of associated circuits with shutdown systems. One approach is to start with the fire area, identify what is in the fire area, and determine the interaction between what is in the fire area and the shutdown systems which are outside the fire area. We have entitled this approach, "The Fire Area Approach." A second approach which we have named "The Systems Approach" would be to define the shutdown systems around a fire area and then determine

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
611 RYAN PLAZA DRIVE, SUITE 1000
ARLINGTON, TEXAS 76011

CHRONOLOGICAL FILE

DCNA098716

SEP 30 1987

In Reply Refer To:
Dockets: 50-313/87-14
50-368/87-14

Arkansas Power & Light Company
ATTN: Mr. Gene Campbell
Vice President, Nuclear
Operations
P. O. Box 551
Little Rock, Arkansas 72203

Gentlemen:

This refers to the inspection conducted by Mr. M. E. Murphy of this office, Messrs. D. J. Kubicki, R. S. Lee, and G. Dick of the Office of Nuclear Reactor Regulation, and Messrs. M. Villaran and K. Parkinson of Brookhaven National Laboratory, during the periods May 4-8 and June 8-12, 1987, of activities authorized by NRC Operating Licenses DPR-51 and NPF-6 for Arkansas Nuclear One, Units 1 and 2, and to the discussion of our findings with Mr. S. M. Quennoz and other members of your staff at the conclusion of the inspection.

Areas examined during the inspection included implementation of and compliance to the safe shutdown requirements of 10 CFR 50, Appendix R. Within these areas, the inspection consisted of selective examination of procedures and representative records, interviews with personnel, and observations by the NRC inspectors. The inspection findings are documented in the enclosed inspection report.

During this inspection, it was found that certain of your activities were in violation of NRC requirements. Consequently, you are required to respond to this violation, in writing, in accordance with the provisions of Section 2.201 of the NRC's "Rules of Practice," Part 2, Title 10, Code of Federal Regulations. Your response should be based on the specifics contained in the Notice of Violation enclosed with this letter.

During this inspection, it was found that certain of your activities appeared to deviate from accepted industry standards/commitments made to NRC. These items and references to the standards/commitments are identified in the enclosed Notice of Deviation. You are requested to respond to these deviations in writing. Your response should be based on the specifics contained in the Notice of Deviation enclosed with this letter.

Three unresolved items are identified in paragraphs 3, 9.a(5), and 11.b(1) of the enclosed inspection report.

The response directed by this letter and the accompanying Notice is not subject to the clearance procedures of the Office of Management and Budget as required by the Paperwork Reduction Act of 1980, PL 96-511.

Should you have any questions concerning this inspection, we will be pleased to discuss them with you.

Sincerely,

J. E. Gagliardo, Chief
Reactor Projects Branch

Enclosures:
1. Appendix A - Notice of Violation
2. Appendix B - Notice of Deviation
3. Appendix C - NRC Inspection Report
   50-313/87-14
   50-368/87-14
4. Attachment to Inspection Report

cc w/enclosures:
J. M. Levine, Director
  Site Nuclear Operations
Arkansas Nuclear One
P. O. Box 608
Russellville, Arkansas 72801

Arkansas Radiation Control Program Director potential and energy in CT secondaries such that secondary fires could not be induced by open CT secondaries.

The licensee's protection for current transformer open secondary concerns was found to be satisfactory.

(3) Isolation of Fire Instigated Spurious Signals

The licensee has provided isolation for fire-instigated spurious signals by various methods, including:

- administrative controls,
- rerouting of cables,
- wrapping cables,
- isolation/transfer switches (redundant fuses used),
- fuses,
- signal isolators, and
- manual component operation.

During the inspection, all forms of isolation listed above were observed.

The licensee's methods of fire instigated spurious signal isolation were found to be satisfactory.

c. Common Enclosure

The common enclosure associated circuit concern is found when redundant circuits are routed together in a raceway or enclosure and they are not electrically protected, or fire can destroy both circuits due to inadequate fire protection means.

Licensee representatives stated that:

- Redundant safe shutdown cables are never routed in common enclosure.
- Nonsafety-related cables routed in common enclosure with redundant safety-related cables are never routed between redundant trains.
- All circuits are electrically protected.

During the inspection, the following randomly selected nonsafe shutdown cables routed in common enclosure with safe shutdown cables were verified to be electrically protected:

Component	Cable Number	Location	Protection
2CV8831-1	R2B53A4A	Raceway EB156	Circuit Breaker 2B53A4
2CV1074-1	R2B53C1C	Raceway EB156	Circuit Breaker 2B53C1

The licensee's control of cables was found to be satisfactory.

b. Review of Unit 1 Cable Routing Open Item

During the May 1987, Unit 1, Appendix R inspection, cable separation/routing was found to be an unresolved item pending documentation review and physical in-plant inspection. The following circuits were inspected during the week of the June 1987 Appendix R inspection for Unit 2 to clear the Unit 1 cable routing unresolved item:

Components	Type Cables
CV1407 and CV1408 (BWST)	Power and Control
CV1219 and CV1220 (HPSI)	Power and Control
PSV1000 and CV1000 (PZR PORV)	Power and Control
CV1228 and CV2618 (SG ATMOS) (and associated block valves)	Power and Control
P4A/B/C (Service Water Pumps)	Power and Control
LT1001 and LT1002 (PZR Level)	Instrumentation
PT1042 and PT1041 (RCS Press)	Instrumentation
TE1144 and TE1147 (TCS Temp)	Instrumentation
LT2620 and LT2624 (SG Level)	Instrumentation
NE 501 and NE 502 (Source Range)	Instrumentation
LT4204 and LT4205 (CST Level)	Instrumentation
• Redundant Components in Fire Area B requiring manual operation	Power and Control

Documentation review and physical in-plant inspection for Unit 1 cable separation/routing was completed satisfactorily. This closes the unresolved item from the May 1987, ANO-1 inspection (see paragraph 7.d).

c. Modification Review

The licensee's process for controlling the design and installation of modifications was reviewed for proper review and approval, including 10 CFR 50.49 aspects.

affects plant operation. The fire brigade leader must stay with the fire brigade and be assigned no other responsibilities during a fire emergency, therefore, the shift supervisor must be excluded from membership on the fire brigade.

I. *Fire Brigade Training—Comment Resolution.* Many commenters have stated that NRC used unnecessary detail in spelling out specific requirements for classroom instruction, fire fighting practice, and fire drills. Some commenters felt that these requirements were more detailed than anything the Commission has published with regard to operator training. The Commission here points out that most of the investigations of the TMI accident identified inadequately trained operators as an important factor and that work is now being done in this area. The fact is not that the training requirements spelled out here for the fire brigade members are excessive when compared to training requirements for reactor operators, but that fire brigade training is further along in development, and training parameters that are essential to a comprehensive program ~~have been identified.~~

J. *Emergency Lighting Technical Basis.* Emergency lighting is required in all nuclear power plants. Battery-powered lights with capacities of 1½ to 2 hours is usually sufficient for emergency egress. However, the postfire emergency lighting requirements in a nuclear power plant are of a different kind. The need is for lighting that aids the access to equipment and components that must be manually operated by plant personnel to effect safe plant shutdown during plant emergencies. Because such activities may extend over a considerable period of time both during and after the fire, it is prudent to provide 8-hour battery emergency lighting capability to allow sufficient time for normal lighting to be restored with a margin for unanticipated events.

Comment Resolution

Many commenters stated that the requirement for emergency lighting is overly restrictive in three specifics: first, that emergency lighting is unnecessary in many of the designated areas; second, that the requirement for sealed beam or fluorescent units is overly restrictive; third, that the requirement for individual 8-hour battery power supply is excessive. Three commenters recommended a 2-hour battery power supply; five commenters recommended a plant-specific power supply; and one commenter recommended that there be no permanent installation.

These suggestions have been accepted in part. Lighting units with 8-hour battery supplies are to be provided in all areas needed for operation of safe shutdown equipment and in access and egress routes thereto. The reasoning behind the requirement for an 8-hour battery power supply is that there can be a great deal of other activity during a fire emergency and operators involved in safe plant shutdown should not also have to be concerned with lighting in the area. The small cost differential between 2-hour supply and the substantial additional protection afforded by the 8-hour supply does not warrant reducing this requirement. The Commission has decided to require an 8-hour battery power supply in all areas needed for operation of safe shutdown equipment and in access and egress routes.

K. *Administrative Controls Technical Basis.* The fire protection program uses administrative controls for fire prevention and prefire planning. The items listed in this section are generally accepted within the fire protection community as minimum requirements for an effective administration of the fire protection program. Controls are placed on the storage and use of combustible materials to reduce the fire loading in safety-related areas and on ignition sources to avoid careless operations. Procedures are used to control actions to be taken by individuals who discover a fire and by the fire brigade for the development of preplanned fire fighting strategies and actual fire fighting techniques.

Comment Resolution

Many commenters stated that this requirement was much too detailed for a regulation. Some stated that the requirements should apply only to those areas having safe shutdown equipment. Other commenters stated that a simple statement that administrative procedures should be established to control the various fire hazards throughout the plant was sufficient, and that the details could be spelled out in a regulatory guide or some other similar document.

Minor changes have been made in the wording of this requirement for clarification.

L. *Alternative and Dedicated Shutdown Capability.*

Technical Basis. In some locations (such as the cable spreading room) within operating nuclear power plants, it is not always possible or practicable to protect redundant safe shutdown systems against adverse effects of fire or fire suppression activities only through the use of fire protection features because the redundant safe shutdown systems in a given fire area are too close to each other. Alternative shutdown capability has usually been required to be independent of the control room, cable spreading room, switchgear rooms and cable riser areas because redundant systems in these areas are not adequately separated. When plant modifications to provide alternative shutdown systems are extensive, a dedicated system that is essentially a minimum capability safe shutdown train and is independent of those already existing may be provided. ~~This minimum capability is required to maintain the process variables within those values predicted for a loss of offsite power.~~ The case of loss of offsite power is assumed because fires in certain circumstances (e.g., electrical distribution systems) could cause or be related to such a loss. Fire damage to cold shutdown capability is limited to damage that can be repaired within 72 hours to provide a margin in achieving cold shutdown conditions. Consideration is given to associated circuits because most plants were not designed with this concept in mind. Should either the alternative or dedicated capability be required to function because of a fire, it must not be disabled by fire damage to associated circuits. Also, this capability does not have to meet the single failure criterion because it is only one of several levels of defense. Seismic Category I criteria is not imposed because fires that would require the installation of alternative or dedicated shutdown capability are not seismically induced.

Comment Resolution

Many of the commenters stated that this requirement exceeded the scope of Appendix R by defining alternative shutdown requirements. They stated that the time requirements are excessive and should be dropped. They also contend that this regulation does not take into account the many plant reviews being conducted under the Systematic Evaluation Program (SEP).

It is generally understood that cold shutdown is the ultimate safe shutdown condition and that, for each fire area, different means may be used and may be necessary to achieve cold shutdown. Because a fire in certain areas at some plants would have the capability of disabling systems required to achieve both hot and cold shutdown, it is necessary to specify the minimum capability and time requirement for each condition necessary to achieve safe shutdown. We agree that evaluations being made under the Systematic Evaluation Program (SEP) may also call for alternative or dedicated shutdown capability for reasons other than fire protection. For example, seismic, flooding, or emergency core cooling requirements resulting from the SEP may require additional modifications. Each licensee should be aware of the status of

c. Examine alternative or dedicated shutdown equipment. Verify that it is independent of the fire area, room or zone under consideration and that electrical isolation is provided as described in the applicable NRR SERs, and their supplements or other applicable licensing documents.

d. Review the licensee's surveillance program for testing the reliable operation of alternative or dedicated shutdown equipment. Establish that a controlled postfire safe shutdown has been shown to be achievable from outside of the control room. Furthermore, verify that the transfer of control from the control room to the alternative location for equipment required for safe shutdown is demonstrated. Verify that this transfer ensures that operation of this equipment is not affected by fire-induced spurious operation. Also, verify that upon transfer of control from the control room to the alternative location, required circuits are protected by separate fusing and power supplies.

e. Verify that the licensee's training program for licensed and non-licensed personnel has been expanded to include alternative or dedicated safe shutdown capability.

f. 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.

g. 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. The licensee can be requested to demonstrate the adequacy of the alternative shutdown procedures by "walking through" the procedural steps.

h. Verify, on a sample basis, that installation of necessary fire detectors and automatic fire suppression systems required by Section III.G.3 of Appendix R is as described in NRR SERs and their supplements or other applicable licensing documents. In addition, verify that the installation of automatic suppression systems would adequately suppress fires associated with the hazards of the areas.

i. 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 72 hours.

02.03 <u>Section III.J., Emergency Lighting</u>

a. Verify that the plant emergency lighting capabilities meet the following requirements of Section III.J. of Appendix R.

1. <u>Required Areas for Emergency Lighting</u>

(a) control room (unless specifically excluded as a requirement through exemption or deviation)

(b) other critical area(s) and access routes which require illumination to allow manual safe shutdown equipment operation or the monitoring of safe shutdown indications

2. If the emergency lights are powered from a central battery or batteries, then the distribution system must contain protective devices such that a fire in one area will not cause a loss of emergency lighting in any unaffected area needed for safe shutdown operations.

3. Review the manufacturer's information to verify that battery power supplies are rated with at least an 8-hour capacity.

b. In addition to the regulatory requirements of III.J, the following areas should be reviewed:

1. Tour the plant and inspect the emergency lights installed in areas required for postfire shutdown and in the access routes to those areas. By requesting the licensee to perform an emergency lighting test for selected plant areas, verify the following:

(a) the lamps are properly aimed

(b) the batteries are being properly maintained including:

- charge rate indication (lamp or meter)
- specific gravity indication is within specification

(c) sufficient illumination is provided to permit access for the monitoring of safe shutdown indications and/or the proper operation of safe shutdown equipment

2. 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.

02.04 <u>Section III.O, Oil Collection Systems for Reactor Coolant Pumps</u>

a. Review the drawings and calculations for the oil collection system to verify that all potential leakage points in the reactor coolant pump oil system have been contained and the drain line(s) have been sized to accommodate the maximum leak rate.

b. Verify that the oil collection system components have been designed so that there is reasonable assurance that they would withstand the safe shutdown earthquake (see Section III.O of Appendix R) or that the RCP lube oil system and associated appurtenances are seismically designed to withstand the safe shutdown earthquake and that the licensee has submitted and NRR has approved an exemption for a non-seismically designed oil collection system. See GL 86-10 (reference 04.11), Enclosure 2, Question 6.1.

Verify through inspection of the contents of designated emergency storage lockers and review of alternative shutdown procedures, 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 capability 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). If specific, risk-significant issues arise relating to alternative shutdown communications adequacy, then, on a not-to-interfere with operational safety basis, observe licensee conducted communications tests in the subject plant area or areas.

7. Emergency Lighting

Review emergency lighting provided, either in fixed or portable form, along access routes and egress routes, at control stations, plant parameter monitoring locations, and at 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.

(c) Determine if the operability testing and maintenance of the lighting units follow licensee procedures and accepted industry practice.

(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.

(e) Verify that emergency lighting unit batteries are being properly maintained (observe the unit's lamp

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001
May 13, 1998

Mr. Robert G. Byram
Senior Vice President-Generation
and Chief Nuclear Officer
Pennsylvania Power and Light Company
2 North Ninth Street
Allentown, PA 18101

SUBJECT: FIRE PROTECTION FUNCTIONAL INSPECTION OF SUSQUEHANNA STEAM ELECTRIC STATION UNITS 1 AND 2 (NRC INSPECTION REPORT NOS. 50-387/97-201 AND 50-388/97-201)

Dear Mr. Byram:

From October 20-24, and November 3-7, 1997, the staff of the U.S. Nuclear Regulatory Commission (NRC), Office of Nuclear Reactor Regulation (NRR), with technical inspection support from Brookhaven National Laboratories (BNL) and NRC Region 1, performed a pilot fire protection functional inspection (FPFI) at the Susquehanna Steam Electric Station (SSES). The FPFI evaluated the adequacy of the SSES fire protection program and its ability to: (1) prevent fires from starting, and (2) detect, control, suppress, and extinguish fires quickly; it also assessed the capabilities of the plant to achieve and maintain post-fire safe-shutdown conditions using systems and components that have been protected and known to be free of fire damage.

In addition, this inspection evaluated the fire protection program's adherence to the design and licensing bases as established by Operating License NPF-14 (Unit 1), Condition 2.C(6) and NPF-22 (Unit 2), Condition 2. C(3); NRC safety evaluation reports; the SSES Final Safety Analysis Report (FSAR); the SSES Fire Protection Review Report (FPRR); and safe-shutdown analyses. Within the areas inspected, the team examined procedures and records, interviewed plant operations and engineering support personnel, examined plant equipment and structures, and observed simulated responses to fire events. The enclosed report presents the detailed scope and results of this inspection.

From the FPFI, the inspection team determined that the operational aspects (e.g., fire prevention program administrative controls) were satisfactory and appropriately implemented. However, the team noted weaknesses associated with the design of certain plant fire protection features, fire brigade effectiveness, and certain aspects of the engineering analyses used to demonstrate that post-fire safe-shutdown conditions can be achieved and maintained.

Specifically, the team found some problems with the design of certain fire suppression and detection systems and their lack of conformance to industry fire protection standards; the fire brigade's ability to control and extinguish flammable/combustible liquid fires safely because of the plant policy to restrict the use of fire fighting foam on site; during an unannounced drill, the fire brigade was hindered by equipment logistics and deployment problems; the post-fire safe-shutdown methodology does not meet the Appendix R reactor performance goals-by maintaining the reactor water level above the top of the active fuel or by assuring the availability of keep-fill to prevent water hammer in the high-pressure core-injection system, reactor core isolation cooling system, core spray system, and residual heat removal system discharge piping; the preferred post-fire safe-shutdown instrumentation and required post-fire safe-shutdown manual actions were not found in the procedures used for post-fire safe-shutdown from inside the control room; required emergency lighting was not provided in all plant areas in which post-fire safe-shutdown manual actions are taken, and a program that assures the operability of required emergency lighting in the "E" diesel building was not instituted; and the independent plant examination for external events (IPEEE) does not consider plant operational or fire conditions that could propagate into a large fire.

As with all NRC inspections, we expect that you will evaluate the applicability of the results and specific findings of this inspection to other systems, components and programs throughout the plant. You are requested to respond to the inspection report findings within 60 days from receipt of this letter. In your response to the inspection findings, you should document any specific actions you have taken in response to the inspection. After reviewing your response to the inspection findings, the NRC will determine whether further NRC enforcement action is necessary to ensure compliance with NRC regulatory requirements.

In accordance with 10 CFR 2.790(a), a copy of this letter and the enclosure will be placed in the NRC Public Document Room. Any enforcement action resulting from this inspection will be handled by NRC Region I staff and will be addressed by separate correspondence. Should you have any questions concerning this inspection, please contact the project manager, Victor Nerses, at 301-415-1484, or the inspection team leader, Patrick M. Madden, at 301-415-2854.

Sincerely,

Robert A. Capra

Robert A. Capra, Director
Project Directorate
Division of Reactor Projects I/II
Office of Nuclear Reactor Regulation

Docket Nos.: 50-387
and 50-388

License Nos.: NPF-14 (Unit 1)
NPF-22 (Unit 2)

Enclosure: NRC Inspection Report 50-387, 388/97-201

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U.S. NUCLEAR REGULATORY COMMISSION
HEADQUARTERS

Docket Nos:	50-387 (Unit 1) 50-388 (Unit 2)
License Nos.:	NPF-14 (Unit 1) NPF-22 (Unit 2)
Report Nos.:	50-387/97-201 (Unit 1) 50-388/97-201 (Unit 2)
Licensee:	Pennsylvania Power and Light
Facility:	Susquehanna Steam Electric Station
Location:	Salem Township, Luzerne County, Pennsylvania
Dates:	October 20-24 and November 3-7, 1997
Inspectors:	Patrick M. Madden, Team Leader Fire Protection Engineering Section (FPES) Plant Systems Branch (SPLB) Division of Systems Safety and Analysis (DSSA) Office of Nuclear Reactor Regulation (NRR) Mark Salley, Fire Protection Engineer FPES/SPLB/DSSA/NRR J.S. Hyslop, PRA/IPEEE Analyst Probabilistic Safety Assessment Branch (SPSB) DSSA/NRR Roy Fuhrmeister, Fire Protection Inspector NRC Region I
Contractors:	Kenneth Sullivan, Electrical Engineer Brookhaven National Laboratories Richard Deem, Reactor Systems Engineer Brookhaven National Laboratories
Approved By:	Ledyard B. Marsh, Chief, Plant Systems Branch Division of Systems Safety and Analysis Office of Nuclear Reactor Regulation

Enclosure

EXECUTIVE SUMMARY

Susquehanna Steam Electric Station
Fire Protection Functional inspection Report 50-387/97-201 and 50-388/97-201

Susquehanna Steam Electric Station (SSES) is a dual unit station consisting of two General Electric boiling-water reactors (BWR Type 4) having Mark II containment. The rated output of Unit 1 is 1050 MWe and Unit 2 is rated at 1168 MWe. Unit 1 entered commercial operation in June 1983 and Unit 2 started in February 1985. During the weeks of October 20-24 and November 3-7, 1997, a team of Nuclear Regulatory Commission (NRC) and Brookhaven National Laboratory (BNL) engineers conducted a Fire Protection Functional Inspection (FPFI) at SSES. The NRC staff held the FPFI exit meeting with the licensee on November 7, 1997.

Section 50.48 of Title 10 of the Code of Federal *Regulations* (10 CFR 50.48) requires that all operating nuclear power plants have a fire protection plan that satisfies General Design Criterion (GDC) 3 of Appendix A of this part. Operating License NPF-14 (Unit 1) Condition 2.C (6) and NPF-22 (Unit 2) Condition 2.C(3) specify that the licensee implement and maintain in effect all provisions of the approved fire protection program as described in the Fire Protection Review Report (FPRR) for the facilities and as approved by the NRC Safety Evaluation Report (SER) dated August 9, 1989. The NRC based its approval of the SSES fire protection program on the licensee's commitment to follow the guidance of Appendix A to Branch Technical Position (BTP) Auxiliary Power Conversion Systems Branch (APCSB) 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants," and the licensee's commitment to meet Sections 111.G, 111. J., and 111.L of Appendix R to 10 CFR Part 50.

While this inspection included a risk-informed evaluation of the fire protection program developed by the licensee, Pennsylvania Power and Light (PP&L), the inspection focused on assessing the fire safety factors at SSES Units 1 and 2 and the ability of each unit to achieve and maintain safe-shutdown conditions in the event of fire in any area of the plant.

Specific areas reviewed by the Fire Protection Functional Inspection team included:

- Compliance with Sections III.G, III.J, and III.L of Appendix R to 10 CFR Part 50 and the plant's ability to achieve, maintain, and implement the post-fire safe-shutdown capability.
- The adequacy of separation and/or protection provided for redundant trains of equipment and cables required to achieve and maintain safe-shutdown conditions in the event of fire.
- The scope of the analysis performed and the adequacy of protection provided for non-essential associated circuits of the plant's post-fire safe-shutdown capability.
- The post-fire alternative shutdown analysis methodology and the adequacy of procedures developed to implement this methodology.
- Whether the plant fire protection program has been fully implemented and maintained in accordance with the guidance of Appendix A to BTP APCSB 9.5-1.

- The 10 CFR 50.59 change process as applied to the fire protection program and how the process assures the NRC-approved fire protection program is maintained.

- The ability to mitigate the consequences of a fire resulting from a plant event.

In addition, the FPFI team reviewed fire safety considerations that are not expressly addressed by the fire protection regulation. For example, the team assessed the plant fire protection program and licensee initiatives to implement improvements in state-of-the-art fire detection, control, and extinguishment technology.

Summary of Findings

The following items in the area of fire protection engineering and program implementation were identified during this inspection:

- During a plant walkdown, in the essential safeguards service water (ESSW) pump house, the team found that Nuclear Department Administrative Procedure (NDAP) NDAP-QA-0440, Rev. 2, "Control of Transient Combustible/Hazardous Materials," and NDAP-QA-0552, Rev. 1, "Transient Equipment Controls," were not fully implemented.in that plant personnel failed to adequately control transient combustible materials and to perform the appropriate engineering evaluation on securing transient equipment to plant components or structures (see Report Section F1. 1).

- The team found the fire brigade equipment disorganized and not ready to be rapidly transported to the fire scene and promptly deployed. Problems with equipment logistics and deployment could affect the fire brigade's ability to control and extinguish a fire in a timely manner. The team also noted that the licensee has prohibited the use of fire fighting foam on site and considers this a weakness. In the event of a fire involving flammable or combustible liquids, the use of fire fighting foam can improve manual fire control and extinguishment effectiveness and at the same time provide re-flash protection to fire brigade personnel (see Report Section F2. 1.1).

- The team observed a fire brigade unannounced drill. This drill scenario was a fire in the B diesel generator room. Since the diesel generators are accessed from the outdoors, the fire brigade van was used to provide support equipment. It took the brigade 23 minutes to get ready and into position with a hose line to enter the diesel generator room. A critique was held immediately after the drill. The most significant issue identified during the critique was that the brigade leader couldn't understand the transmissions from personnel wearing self-contained breathing apparatus (SCBAs). After the critique, the team noted the extensive amount of time required for the first hose team to reach the fire area and the general uninterested attitude exhibited by the brigade members (see Report Section F3.3).

- The team noted that the Nuclear Training Department does not track the physical (medical) examinations of the fire brigade members. However, if a physical is overdue, the member's "name appears on the monthly fire brigade report. Operations Department had changed over to biennial physicals for fire brigade members in 1995. The entire operations fire brigade complement received its first biennial physicals in 1996. The team pointed out that the NDAP-QA-0445 requirements still called for annual physicals and the basis for this change was questioned. The change to biennial fire brigade physical examinations does not satisfy the medical criteria established by industry standards and NRC fire protection program guidelines or requirements for the fire brigade members to have annual physical examinations, as established by plant procedure NDAP-QA-0445 (see Report Section F4.1).

- The team's review of the depth and scope of the fire protection program audits determined that they did not fully assess compliance with Appendix R. The 1994, 1995, and 1996 fire protection program audits did not perform audit samples in the following areas: design basis reverification of plant fire protection features; reverification of the fire-induced electrical fault evaluation and the electrical-engineering aspects of Appendix R (e.g., fuse breaker coordination, common enclosure, spurious equipment operations); reverification of systems and logic used to support the safe-shutdown methodology and the fire protection features for those systems; reverification and evaluation of operational implementation of the safe-shutdown analysis; evaluation of major plant modifications for potential impact on the plant fire protection program and/or the plant safe-shutdown analysis (see Report Section F5.2).

- The licensee's off-normal (ON) procedure ON-037-001 states that the condensate transfer system (CTS) or other method of maintaining keepfill is required for high--pressure core injection (HPCI), reactor core isolation cooling (RCIC), the core spray system (CSS), and residual heat removal (RHR) to prevent water hammer in the discharge piping. The CTS and the cross-tie to the demineralized water system alternative keepfill scheme are not powered from a 1 E bus, which would make them unavailable during a fire event that causes the loss of offsite power (LOOP). Since normal methods of maintaining keepfill were not credited by SSES for post-fire safe shutdown, the team noted that the loss of this capability may result in excessive water hammer in required shutdown systems. To preclude such an occurrence, PP&L has developed an alternate keepfill scheme which involves the installation of a temporary cross-tie, using a hose to supply water from the fire water system to the CTS. Since this scheme involved manual actions with staged equipment, the licensee was asked to demonstrate the scheme's feasibility. During the team's walkthrough of the procedure, tools and equipment required to make the connection between the CTS and the fire water system were not available. Additionally, the team noted that the emergency lighting in the area where actions were to be performed did not appear to be sufficient (see Report Section F6.I.1).

- The licensee was granted an exemption to use an automatic depressurization system/core spray (ADS/CS) shutdown methodology in lieu of an RCIC/HPCI high-pressure methodology. The acceptance of this method was based on the licensee's claim that this low-pressure methodology did not allow the reactor pressure vessel (RPV) water level to go below top of active fuel (TAF). In EC-013-0843 (pg. 70), the licensee stated that spurious safety relief valve (SRV) opening from fire-related damage could cause the RPV water level to go below TAF. Additionally, in calculation

EC-01 3-0509, "Minimum Reactor Water Level Under Spurious SRV Operation During a Control Room Fire," Rev. 1, dated July 7, 1994, the licensee did a thermal-hydraulic analysis and found that the spuriously opening one or two SRVS would cause the RPV water level to go below TAF (see Report Section F6. 1.1).

- The licensee's ON procedures for post-fire safe shutdown are symptom based. These procedures direct the operators to use other off-normal and emergency operating procedures (EOPs), depending on the availability of plant equipment. However, these other procedures do not take into account the impact of fire damage, including the potential for fire-induced spurious signals on shutdown systems. For example, the normal shutdown procedures would not contain cautions on the possibility that hot shorts could change valve positions or give the operators false instrumentation readings. In reviewing the licensee's procedures for implementing a safe shutdown of the plant following a fire in plant areas not requiring main control room (MCR) evacuation, the team found that preferred instrumentation and equipment that would be free of fire damage was not identified by the safe-shutdown procedures by fire area or fire zone, although this information was available in the licensee's safe-shutdown analysis (SSA). These procedures did not provide guidance regarding the manual operator actions which may have to be performed for specific fire area or zones in order to implement post-fire safe shutdown. Depending on the location of the fire, the licensee's SSA requires different post-fire safe shutdown manual actions to be performed for different fire areas (see Report Section F6.2. 1).

- The team verified that RPV level and temperature instruments identified in the EOPS are *not* necessary to satisfy a literal interpretation of Appendix R requirements and staff guidance and that failure to perform repair activities specified in procedure would not preclude the ability to achieve and maintain post-fire safe shutdown (PFSSD). However, from discussions with plant operators it appears that the availability of these instruments would significantly enhance the shutdown capability. As a result it is expected that during a fire event operators would request plant instrumentation and control (I&C) technicians to perform the repair activities as specified in the procedure. Based on a walkdown 'of procedural actions necessary to perform the repairs, it was determined that actions necessary to install the temporary RPV temperature indication were not feasible; technicians would need to erect scaffolding, and work in a high-radiation area (straddling a RHR line that is approximately 20' off the floor). In addition, there was no emergency lighting, and equipment and tools necessary to perform repairs were not dedicated for use (see Report Section F6.2.2) .

- The team identified issues associated with the installed fire detection system and its ability to meet the minimum installation criteria established by the applicable National Fire Protection Association (NFPA) code of record (COR). High ceilings, deep beam pockets, and detector spacing limitations should be considered simultaneously in establishing the limiting parameters of the system design. Evaluating one parameter, without considering the others, will give a false impression of the design. The licensee could not adequately demonstrate that the fire detection system in the areas inspected met minimum industry fire protection codes. Specifically, the licensee could not. demonstrate that the design considered all environmental and physical aspects of the installation including, but not limited to high ceilings, effects of the ventilation system on smoke movement, obstructions, and beam pocket ceiling construction (see Report Section F6.4.1).

- The team identified plant conditions that could affect the ability of the sprinkler system to react to a fire. The team concluded that certain sprinklers systems installed at SSES exhibited weaknesses in meeting the NFPA COR. Specifically, the COR guidance pertaining to the placement of sprinkler heads, sprinkler head coverage, and obstructions to the area of coverage (see Report Section F6.4.3).

- From its review of CO_2 suppression systems installed at SSES, the team concluded that these systems, because of the lack of appropriate pre-operational system discharge testing, might not be capable of performing their intended fire control function. In addition, because of the licensee's concern about thermal shock to electrical equipment, the team concluded that the application of these systems might not meet the intent of GDC 3, "Fire Protection," of Appendix A to 10 CFR Part 50 (see Report Section F6.4.4).

- The team performed a walkdown of the standpipe hose stations in the control building. SSES uses a Class II system as defined by the NFPA COR. The NFPA COR states: "The number of hose stations for Class II service in each building and each section of a building divided by fire walls shall be such that all portions of each story of the building are within 30 feet of a nozzle when attached to not more than 100 feet of hose." During the week of October 27, 1997, PP&L personnel walked down additional hose stations and found that the hose strainers did not meet the licensing and design basis because they could not provide the required area of coverage with the allotted 100' of hose (see Report Section F6.4.5).

- During the team's walkdown of emergency lighting, the licensee could not demonstrate that adequate emergency lighting existed for supporting the following post-fire safe shutdown operations: (1) checking the reactor water cleanup system (RWCU) equipment for leakage, (2) opening breaker 1 Y219-018 to stop RWCU leakage or diverting reactor water to radwaste or the condenser via RWCU, and (3) closing flow control valve HV-243-F023A at motor control center 2B237043. In addition, the required emergency lighting units (ELUs) in the E diesel generator building were not receiving appropriate testing and maintenance (see Report Section F6.5.1).

- The team identified several weaknesses with the Individual Plant Examination of External Events (I PEEE fire analysis and its assumptions: (1) large fires due to combustibles allowed by administrative limits are not modeled, (2) the cable spreading room has been omitted from the analysis as lacking combustibles even though cables in the cable spreading room are combustible and transient combustibles are allowed in the room by procedure, and (3) cabinet 1 C601, the emergency core cooling system (ECCS) cabinet in the control room, has penetrations between cabinet sections and can potentially be damaged in a single fire (see-Report Section F6.6).

Strengths / Positive Observations

- The PP&L technical personnel supporting the inspection exhibited a great deal of interest in and knowledge of the fire protection features and post-fire safe shutdown capability of SSES. Additionally, the team found licensee representatives to be candid, clear, and informative. They were professional and knowledgeable of NRC fire protection regulations and guidance and the corporate history of the development of the SSES fire protection program. The plant's fire protection features and post-fire safe-shutdown capability. The high quality of the licensee's technical, operations, and management organizations responsible for ensuring the post-fire safe-shutdown capability of SSES was viewed as a major strength by the team.

- The scope and depth of the training program for operators at SSES was observed to be good. This observation was supported by the simulator demonstration that was carried out by the "shift in training" for an MCR fire scenario.

- The techniques developed for aiming the emergency lighting units and maintaining the proper aim were good. The aiming markings on the units and their lamp receptacles were easily identifiable and supported the ready verification of proper aim.

- PP&L identified the fire-resistive limitations of its Kaowool raceway fire barrier systems and initiated a proactive response to the technical concerns (e.g., thermal performance limitations). PP&L has included these barrier systems in the scope of its Thermo-Lag resolution program.

- The licensee implemented the necessary plant modifications to its essential post-fire safe-shutdown-related motor-operated valves (MOV) eliminating the fire-induced spurious actuation and the resulting valve control and functional operation concerns.

Report Details

IV. Plant Support

F1 Control of Fire Protection Activities

F1. 1 Combustible Material Controls/Fire Hazards Reduction

a. Inspection Scope

The team reviewed NDAP-QA-0440, Rev. 2, "Control of Transient Combustible/Hazardous Materials," observed conditions in the plant, and discussed combustible material control with the site fire protection engineer (SFPE).

b. Observations and Findings

NDAP-QA-0440 establishes the administrative controls for the use and storage of combustible and hazardous materials in the plant. The intent of the procedure is to minimize the amount of transient material in the plant. The procedure establishes a permit system for bringing transient combustibles into the plant and for the use of temporary space heaters. The SFPE approves the permits after reviewing the other hazards at the proposed location and imposing any necessary limits. Maximum allowable transient combustible loadings have been established for the safety-related areas of the plant, specified as equivalent average fire severity when equated to the standard time-temperature curve. It should be noted that this practice has theoretically been determined to be technically incorrect. The NFPA "Fire Protection Handbook," 18th Edition, discusses the limitations and inaccuracies associated with using this method to make a fire hazard assessment or evaluation. For non-safety-related areas, the loading has been limited to 15 minute fire severity for transient combustible materials. The procedure also establishes maximum transient combustible amounts which would not require permits (such as 9 maslin mops or 5 pounds of Class A combustibles). Aerosols, open flames, and combustion-generated smoke are not permitted for leak testing. Fire protection personnel are to perform inspections monthly (weekly during outages) and have discrepancies corrected by the responsible work group.

During tours of the plant, the team noted that general adherence to the procedure requirements was good. Transient materials for work in progress (such as painting and erection of temporary work space) were permitted as necessary, and no accumulation of combustible material was found in the plant. One exception was noted: two plastic-cased backpack type vacuum cleaners and several mops in the transient material area at the east end of the ESSW pump house. When the team questioned whether this material should have had a permit, the items were removed from the area.

In addition to the combustible material, the team noted a portable stairway chained and padlocked to a spare conduit at the east end of the ESSW pump house.

NDAP-QA-0552, Rev. 1, "Transient Equipment Controls," prohibits securing transient equipment to snubbers, piping, or conduit without engineering 'approval. The team requested the engineering evaluation and approval for securing the stairs to the conduit. No evaluation or approval could be found, and the stairway was secured to the nearby structural steel as permitted by NDAP-QA-0552.

c. Conclusion

Based upon review of the governing procedure and observations of conditions in the plant, the team concluded that appropriate controls of transient combustible material had been developed and were generally being implemented. However, the team did identify two conditions where personnel did not adhere to appropriate administrative controls.

Plant Technical Specifications (TS), Section 6.0, "Administrative Controls," subsection 6.8.1, requires written procedures to be established, implemented, and maintained covering the activities recommended in Appendix A of Regulatory Guide (RG) 1.33, Rev. 2, February 1978. Appendix A of RG 1.33 specifies that general procedures for control maintenance and administrative procedures to govern the fire protection program be established.

Contrary to the above, during a plant walkdown the team identified conditions in the ESSW pump house where procedures NDAP-QA-0440, Rev. 2, "Control of Transient Combustible/Hazardous Materials," and NDAP-QA-0552, Rev. 1, "Transient Equipment Controls," were not fully implemented in that plant personnel failed to adequately control transient combustible materials and to perform the appropriate engineering evaluation on securing transient equipment to plant components or structures. This is identified as an unresolved item, Failure to follow plant administrative control procedures in the ESSW pump house. (Unresolved Item 50-387, 388/97-201-01)

FI.2 Ignition Source/Fire Risk Reduction

a. Inspection Scope

To evaluate the controls on ignition sources, the team reviewed NDAP-QA-0442, "Control of Ignition Sources," observed activities in the plant involving welding and grinding, and spoke with several fire watches and a work supervisor regarding control of welding activities. In addition, an inspector reviewed the historical records documenting fires at the site since 1993.

b. Observations and Findings

The control of ignition sources procedure applies to hot work within any plant building and within 50 feet of any plant building, structure, tank, or transformer. The intent of the procedure is to prevent fires by controlling the conditions under which hot work is performed. The procedure does not apply to normal hot work performed in the maintenance shops and the chemistry lab. During unit operation, hot work permits are only valid for periods of less than 24 hours. During unit shutdown, permits may extend beyond 24 hours, but are only valid for the duration of the specific job.

Before the work starts, a fire watch must be provided. The fire watch must prepare the work area beforehand, in accordance with an attachment to the permit. The fire watch must remain on station for a minimum of 30 minutes after the completion of the hot work.

During a tour of the facility, the team discussed fire watch responsibilities with two hot work fire watches and a work supervisor. They were waiting for the 30-minute post-work period to expire. The area had been prepared either by removing combustible materials or by covering them with fire retardant-blanket material. In addition, the team noted that gaps where sparks could escape the work area were covered with fire-retardant blanket material. The fire watches were knowledgeable of their duties and responsibilities, and the location of permanent plant fire fighting equipment in the event their issued fire extinguishers proved to be inadequate. The work supervisor stated that the job planning included stopping welding and grinding sufficiently before shift end and lunch breaks to accommodate the 30-minute post-work observation requirement.

The records of fires at the site since 1993 show 17 fires within the protected area during that time. Nine of those fires were related to hot work activities. Of the nine hot-work-related fires, seven resulted from material in the work area (material hidden inside the pipe or beam pocket or under or attached to protective covering, a tool belt left during lunch), and one resulted from a spark leaving the hot work area and traveling 40'. All nine hot-work-related fires were extinguished by the fire watches using portable fire extinguishers.

c. Conclusion

Based on observation of conditions in the plant, discussions with the fire watch personnel, and a review of historical records, the team concluded that the hot-work control program, in conjunction with properly trained and posted fire watch personnel, has been effective in minimizing the impact plant fires caused by hot work may have on safe plant operations. However, given that seven fires resulted from exposed combustible materials in the work area, it would appear that more attention is warranted to removing combustible materials from the area or shielding them from hot work activities.

F2 Status of Fire Protection Facilities and Equipment

F2. 1 Plant Tour and Inspection of Fire Protection Equipment

F2. 1.1 Fire Brigade Equipment

a. Inspection Scope

Accompanied by the SFPE, the team conducted an inventory of the fire brigade sheds and van. An inspector also evaluated storage conditions and equipment accessibility.

b. Observations and Findinas

There are three sheds located in the plant buildings for storing fire brigade equipment: one in the circulating water pump house (676' elevation), one at the south end of the Unit 2 turbine building next to the access point (676' elevation), and one on the turbine operating floor (729' elevation) between the generators. Each shed contains a full complement of fire fighting protective clothing and turnout gear for the brigade members, a set of pre-fire plans, an electric smoke removal fan, and extra hose nozzles. The turbine building sheds also contain emergency medical and victim transport equipment. In addition, the fire brigade van contains a full complement of protective fire fighting clothing for the brigade members, along with extra hose, nozzles, access equipment, and a set of pre-fire plans. Lockers in both the north and the south gate houses contain two full sets of protective fire fighting clothing.

Storage of the manual fire protection equipment was not well organized. In addition, the team did not notice a plan for equipment and transporting the equipment to the scene of the fire in a timely manner and deploying it. There was no consistent placement of flashlights, gloves and hoods, or turnout coats within the sheds. Although orderly placement is not a requirement, the fire brigade response could be delayed as the brigade members search for where they put their gloves, hoods, boots, etc., after last using them (see discussion in Section F3.1).

In addition, with regard to the combustible-liquid fire hazards on site (e.g., turbine lube oil, hydrogen seal oil unit, transformers) the team noticed that the plant did not have adequate fire fighting foam capability on site. The licensee based its position to prohibit fire fighting foams from being brought and used on site on the SER dated April 1981, which restricted the use of fire fighting foam in new fuel storage areas. The basis of the NRC's acceptance of this was that the licensee in Amendment 27 to its Final Safety Analysis Report (FSAR) stated that no fire fighting foam systems would be installed anywhere in the plant. The licensee's interpretation of this SER is that foam is not allowed on site. The prohibition potentially diminishes the fire brigade's ability to safely fight a fire involving flammable or combustible-liquid fire hazards and to control potential re-flash fire conditions.

The team does not concur with the licensee's interpretation of the SER as totally prohibiting the use of fire fighting foam on site. This is considered a program weakness,

c. Conclusion

Based on the observations of the fire brigade equipment, the team concluded that it was not well organized and that the logistics of rapidly transporting equipment to the fire scene and rapidly deploying it could affect the fire brigade's ability to control and extinguish a fire in a timely manner. In addition, the team noted that the licensee has prohibited the use of fire fighting foam on site. The team considers this a program weakness, Fire brigade effectiveness to control and extinguish a flammable or combustible-liquids fire impacted by the policy to restrict the use of fire fighting foams on site.

F2.1.2 General Power Plant Tour of Fire Protection Equipment

a. Inspection Scope

During tours of the facility, the team observed the material condition of the permanently installed manual fire fighting equipment and portable fire extinguishers. The team also discussed the fire protection equipment performance with the SFPE and the fire protection system engineer.

b. Observations and Findinas

The team found that the portable extinguishers were in their assigned locations, were all within their inspection frequency, and were not obstructed. The hose reels were found to be in good repair, with the hoses all within their hydrostatic test interval and the nozzles free of foreign material. The lack of bulging and water-filled hoses indicated that the root valves all shut off tightly and were not leaking. The fire pumps appeared to be well-maintained, and the low run-time of the jockey pump (several minutes every half hour) indicated that the fire main system was not leaking excessively.

c. Conclusion

Based on the observed condition of the manual fire fighting equipment installed in the plant, the team concluded that it was in good repair and well-cared-for.

F2.2 Fire Protection Surveillance Limiting Conditions for Operation and Compensatory Measures

a. Inspection Scope

The team observed the monthly surveillance run of the diesel engine-driven fire pump, reviewed results of several engine-driven fire pump tests over the years, reviewed several years' system flow tests, and discussed the testing with the SFPE and fire protection system engineer. The tests observed or reviewed included the following:

- S0-1 3-001, Rev. 12, Monthly Diesel and Motor Driven Fire Pump Run, performed October 20, 1997

- SO-1 3-001, Rev. 12, performed June 30, 1997
- S0-13-001, Rev. 11, performed July 1 and 2, 1996
- SO-1 3-001, Rev. 10, performed June 25, 1995
- SO-1 3-001, Rev. 10, performed June 26, 1994
- SO-1 3-001, Rev. 9, performed June 20, 1993
- SE-1 3-001, Rev. 5, Three Year Fire Protection System Flow Test, conducted September 9, 1997
- SE-1 3-001, Rev. 4, conducted September 13, 1994
- SE-1 3-001, Rev. 2, conducted August 28, 1991

b. Observations and Findinas

Engine-Driven Fire Pump Testing

For the routine tests of the engine-driven fire pump, the pump is started and run at a flow of 2500 gallons per minute (gpm), and operating data for the pump and engine are monitored and recorded. The data recorded include pump suction pressure, pump discharge pressure, pump flow rate in gpm, engine oil pressure, engine cooling water temperature, and engine speed in revolutions per minute (rpm). Engine parameters are recorded from the skid-mounted indicators. In addition, the calibration of the pressure switch for the automatic start of the pump is checked by isolating the switch from the system, bleeding the sensing line, and recording the pressure at which the pump starts.

During the surveillance run of the diesel engine-driven fire pump on October 20, 1997, the operator in attendance at the fire pump noted slight leakage at the pump discharge pressure relief valve. The leakage was noted on the surveillance procedure to identify the need for a corrective maintenance work order. The pump started at the appropriate pressure, and the pump discharge pressure at 2500 gpm was within the acceptable range. The engine performance parameters (oil pressure, cooling water temperature, rpm) were within the expected ranges, showing that there had not been significant degradation of the pump over time.

In reviewing the historical data for the June tests, an inspector identified that the engine oil pressure had decreased from 70 pounds per square inch (psi) during the June 1993 test to 40 psi during the June 1997 and October 1997 tests. When the inspector questioned the significance of the decreasing trend, the SFPE and system engineer were unable to provide an answer, since they did not trend the data and were, therefore, unaware of the trend.

The fire protection system engineer checked the vendor manual for the engine-driven pump and determined that the normal oil pressure at operating temperature is 30-70 psi. A query to the manufacturer resulted in information that the experience, industry-wide (for this model of engine-driven fire pump), was operating oil pressure in the range of 40-45 psi. The SFPE and system engineer surmised that the earlier years' readings had been taken before the engine reached full operating temperature.

Hiah Pressure Fire Protection Water System Flow Test

The fire protection water system is tested every 3 years to demonstrate the underground piping system has not significantly degraded. The test setup included starting the electric motor-driven fire pump to provide a pressure source and to avoid an automatic start. The system static pressure is recorded with the motor-driven pump running and no flow in the system. Flow is then established through seven different flow paths (at 2000 gpm), in sequence, and the system residual pressure is recorded. in addition, a test is performed to demonstrate that at least 750 gpm can be provided to the hydrant at the ESSW pump house. Acceptance criteria are then developed by multiplying the measured pressure drop by the design system resistance coefficient to get a calculated flow rate. The calculated flow rate must be less than the flow rate measured during the flow test by at least 10 percent. There is no requirement to plot the flow characteristic curve for the flow path and compare the curve to prior test results.

The test results for the three flow tests reviewed, covering a 6 year span, showed that the pressure drop to obtain 2000 gpm through each of the seven paths had decreased. This would indicate that the interior pipe walls have become smoother and/or larger during the past 6 years. A closer review of the data showed that the static pressure also steadily increased over the 6 years. When the inspector brought this to the attention of the SFPE and system engineer and asked for an explanation of the results, they were again unaware of the condition, since they did not trend the data. A review of the work authorizations for 1991 showed that the motor-driven pump discharge pressure relief valve was worked on during January, July, and August 1991. The SFPE and the system engineer surmised that excessive leakage through the pressure relief valve was causing the pump to operate further out on the pump curve, causing a larger discharge pressure drop for the same flow rate at the hydrants.

After the discussions with the inspector, the SFPE and the fire protection system engineer stated that they would reconsider whether they should be trending the pump and system performance data.

c. Conclusion

Based on the review of the test procedures, observation of testing activities, and review of past test data, the inspector determined that the testing being performed adequately demonstrated that the high pressure fire protection water system supplies are adequate and the system is operable. In all cases reviewed, the system or pump met the acceptance criteria. The team considered that the lack of performance data trending by the fire protection staff limited their ability to recognize performance trends that provide early indication of degrading equipment before actual test failures.

F3 Fire Protection Staff Performance

F3. 1 Fire Brigade Drill Exercise

a. Inspection Scope

The team observed an unannounced fire drill to review fire brigade response and the efficiency and effectiveness of their fire control and suppression activities. This drill was conducted on November 5, 1997. In addition, the team observed the post-drill critique. The team discussed its drill observations with the SFPE.

b. Observations and Findings

The team observed a fire drill scenario which was based on an actual event in June 1993. This drill involved smoking insulation on the exhaust piping of a diesel generator. The following time line is based on the team's observation of the fire brigade's initial response:

1630 The control room is notified of smoke in the B diesel generator room.

1640 Operations personnel respond to the B diesel generator room and check for fire. The drill is announced over the plant public address system and the fire brigade is asked to respond. The control room briefs the responding fire brigade leader of the conditions found in the diesel generator room and advises that the fire appears to involve the diesel engine exhaust pipe.

1646 The first fire brigade member arrives on the scene.

1648 The fire brigade equipment van arrives. The remaining four fire brigade members arrive. The fire brigade leader performs a briefing, using Pre-Plan 013-192.

During the briefing the fire brigade puts on its protective clothing.

1700 All fire brigade members are ready to fight fire. They use hose house 1FH-104 and its equipment. A 2-1/2 inch diameter fire hose line is used to supply water to a gated wye controlling two 1-1/2 inch diameter attack hose lines.

1703 The fire brigade leader calls for offsite assistance.

1705 The fire hose lines have been deployed and B diesel generator room is entered.

1715 The fire is declared out and the drill is terminated.

The team observed the fire brigade make initial entry into the affected area, assess fire location and conditions, communicate with the control room, suppress the fire, and ventilate the affected fire area.

The team had the following observations concerning the performance of the fire brigade in responding to the fire.

- The fire brigade leader briefed the brigade members regarding the hazards in the room and the status of the sprinkler system while they were putting on their gear.

- It took the brigade members approximately 11 minutes to put on their personnel protective equipment. An excessive amount of time was spent in sorting out boots to find pairs (two members didn't put on boots) and locating hoods, gloves, and flashlights where they had been left after the last use (one brigade member did not wear boots throughout the drill).

- The team noted that the fire brigade members had problems donning their SCBAS.

- The team did not observe the fire brigade members checking the door for heat before opening it, to enter the building, nor did the team notice the fire brigade nozzle person check the nozzle pattern by flowing water through the nozzle before opening the door.

- The team observed hose deployment problems; the hose was not properly advanced and the gated wye which controls the water to the attack line was not turned on.

Since the diesel generator room accesses are from the outdoors, the fire brigade van was used to provide support equipment. The hose team entered the diesel generator room 23 minutes after the fire was reported. The fire brigade leader remained at the van and maintained radio contact with the main control room, the hose team, and the backup and safety team.

A critique was held immediately after the drill. The most significant issue identified during the critique was that the brigade leader couldn't understand the transmissions from personnel wearing SCBAS.

After the critique, the team told the licensee that the first hose team took a long time to reach the fire area and that the brigade members exhibited an apathetic attitude.

c. <u>Conclusion</u>

The team concluded that the fire brigade's drill performance was weak and fire suppression activities would have been hampered by problems with equipment and fire brigade personnel performance. This is identified as a program weakness-, Fire brigade's effectiveness to control and suppress a fire during a drill exercise impaired by equipment logistics and deployment problems.

F3.4 Offsite Fire Fighting Support

a. Inspection Scope

An inspector visited one of the three offsite fire companies (Salem Township) which would respond in the event assistance was required, and discussed the company's capabilities with the Fire Chief and Assistant Fire Chief. The inspector also checked the quantity and condition of the equipment available. In addition, the inspector reviewed records of fires at the site since 1993 to evaluate offsite responses.

b. Observations and Findings

The Salem Township Fire Company is the first response company for SSES, with Berwick and Shickshinny companies providing backup capability. Each company has the ability to respond with approximately five members during the day shift (more personnel available during evening and night hours). The local offsite fire department is all volunteer and is generally funded by community donations, receiving no tax support from the SSES plant.

The offsite fire companies drill at the site once a year and have training at the PP&L fire school twice a year. The training at the PP&L fire school at Harwood includes extinguishing oil fires using water spray. The three offsite fire departments rotate the "first engine in" response during the onsite drills, so that all three departments are familiar with the procedures and requirements.

When offsite assistance is requested, the fire brigade leader informs the offsite fire department of what needs to be done, and the offsite department performs those activities under their own fire scene commander. Each offsite team is provided with a fire brigade member for assistance and guidance. Each off-site fire department carries a set of adapters so that the various fire fighting equipment can be connected to the fire suppression systems at the plant.

In the event of a major flammable liquid fire (such as a main transformer, paint storage, or fuel tanker fire), the offsite fire department has 5 gallons of aqueous film-forming foam (AFFFF) concentrate available. In the event more foam is needed, it would have to be brought in from a tank farm approximately, 45 minutes away.

The Salem Township Fire Company responded to the site in April and October 1995 to extinguish brush fires on the property, outside the protected area fence.

c. Conclusion

The team concluded that the local offsite volunteer fire department has limited resources for handling some of the significant fire hazards on site. In addition, the team is concerned with the limited manning of the local offsite fire department and its lack of having sufficient equipment to readily commit to a major fire on site. It is the team's opinion that the offsite fire department is limited in capability and that the best way to assure significant fires will be handled efficiently and effectively is to improve onsite manual fire fighting capabilities and response.

F4 Fire Protection Staff Training and Qualifications

F4.1 Fire Brigade Training and Implementation

a. Inspection Scope

The inspector reviewed NDAP-QA-0445, Rev. 2, "Fire Brigade," and NTP-QA-53. 1, Rev. 6, "Susquehanna Fire Safety Training Program," to determine the scope and content of the required fire brigade training program, including initial and continuing training. The inspector also reviewed training records for specific individuals, selected at random, the Monthly Fire Brigade Report for October 1997, and discussed fire brigade qualification with the SFPE, the Operations Department training coordinator, and the fire' instructor at the nuclear training center.

b. Observations and Findinas

The SSES Fire Protection Review Report (FPRR) states in Section 3.2, Item 21, "Fire Brigade": "The fire fighting program will utilize the appropriate National Fire Protection Association codes and standards as guidance." NFPA 27, "Private Fire Brigade," Appendix A to BTP APCSB 9.5-1, and 10 CFR Part 50, Appendix R, "Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979," all provide guidance on the training and qualification of fire brigade personnel. All these guidance documents include, as part of maintaining fire brigade member's qualifications, an annual physical examination to determine their ability to perform strenuous fire fighting activities.

The fire brigade procedure, NDAP-QA-0445, specifies the training and qualification standards for fire brigade members. The training consists of initial and continuing training. The continuing training essentially repeats the eight initial training modules, over a 2 year period, with one module of instruction presented each quarter. One session each year is conducted at the corporate fire school, where brigade members participate as a team and proactively extinguishing training fires.

The records of fire brigade training are maintained on the mainframe computer at the corporate headquarters (in Allentown, PA) by the Nuclear Training Department. The records are not available as a group and must be called up individually. The team reviewed the records for six individuals, selected at random. One individual had not completed the annual fire school within the required time period and had been removed from fire brigade duties.

The Nuclear Training Department does not track the physical examinations of the fire brigade members. However, if a physical is overdue, the member's name appears on the monthly fire brigade report. The physicals are tracked by the departmental training coordinators. Discussions with the operations training coordinator revealed that Operations Department had changed over to biennial physicals for fire brigade members in 1995. The entire operations fire brigade complement received their first biennial physicals in 1996. When the team pointed out that the NDAP-QA-0445 requirements still called for annual physicals, the response was "we'll make him change his procedure." When the team questioned the basis for the change to biennial physicals, it was informed that the company doctor in Allentown stated that they only needed to do physicals every 2 years. This matter was discussed with the SFPE, who said that when he raised the issue and mentioned that NFPA 600 (the current fire brigade standard) specifies annual physicals he was told that PP&L was not committed to NFPA 600. The change to biennial fire brigade physical examinations by a health professional does not satisfy the medical criteria established by industry standards and NRC fire protection program guidelines or the requirements for the annual physical examination established by plant procedure NDAP-QA-0445. This is identified as a program weakness, Failure to meet NDAP-QA4445 procedural requirements for annual physical for fire brigade members.

c. Conclusion

Based on the review of computerized training records, a monthly fire brigade report, and discussions with training center staff, the team found the training and qualification of fire brigade members to be adequate, with the exception of the decision on the part of PP&L not to perform annual physicals.

F5 Quality Assurance In Fire Protection Activities

F5. 1 Site Fire Protection Quality Assurance Implementation

a. Inspection Scope

The team reviewed the licensee's method for assuring that the quality of the fire protection program is properly maintained and that plant modifications do not impact the post-fire safe-shutdown design.

b. Observations and Findings

The technical requirements and the design basis of the SSES Fire Protection Program are governed by NDAP-OA-0449, "Susquehanna SES Fire Protection Program."Plant modifications are governed by MFP-QA-2309, "Design Change Package/Engineering Change Order Preparation." This procedure identifies the responsibilities and activities required for the preparation and review, approval, issuance, and revision of design change packages and engineering change orders. Section 6.3.2 of MFP-QA-2309 identiies the design inputs and considerations to be evaluated by the process and refers to MFP~QA-2308. MFP-QA-2308, "Design Inputs and Considerations," provides the requirements for preparing, reviewing, approving, and revising design inputs and considerations. General Design Guide (GDG) 5, "Design Guid-e for Applicability Criteria for Design Considerations," of MFP-QA-2309 provides assistance to design engineers in determining the applicability and implementation requirements for the design considerations. GDG-5 item 28 and considerations 2, 46, and 47 are related to maintaining the fire protection program, and the safe shutdown analysis. Consideration 2 referstoMPF-QA-2218, "Design Requirements for Maintaining The Safe Shutdown Requirements of 10 CFR 50, Appendix R." This procedure provides guidance and requirements for ensuring a modification maintains compliance with Appendix R. Consideration 46 is related to ensuring the modification does not impact the fire protection program licensing basis as described by the FSAR, the FPRR, and the plant TS. Consideration 47 controls the combustible load analysis. This consideration provides guidance on compiling and maintaining all combustible loading information on a fire zone basis.

c. Conclusion

The team did not have any findings within the area inspected and concluded that the licensee has established a program which reviews proposed plant modifications to determine the potential impact they may have on the approved plant fire protection program, the combustible loading in the plant fire zones of concern, and the post-fire safe shutdown analysis and methodology.

F5.2 Site Fire Protection Quality Assurance Audits

a. Inspection Scope

The SSES TS, Section 6.5.2.8, paragraphs (l), (g), and (h), require certain audits of the fire protection program and its implementation to be performed. The team performed a sample review of the scope of the TS-required fire protection program audits to determine if all aspects of the approved fire protection program were being audited.

b. Observations and Findinas

The team reviewed the scope of the triennial fire protection program audit report dated October 16, 1996, the annual fire protection inspection and audit reports dated August 8, 1995, and October 17, 1994, and the recently completed 2-year audit draft report, which had been performed to assist PP&L with its preparation for this FPFI. Excluding the recently conducted audit, these audits generally evaluated specific fire protection activities (e.g., fire watches, control of combustibles, maintenance of fire protection systems); administrative activities related to fire protection (e.g., site personnel fire fighting qualification and retraining, fire emergency plans); post-fire safe-shutdown capability (e.g., fire protection for safe-shutdown capability, cable separation, emergency lighting); design control; control of purchased material, equipment, and services; the licensee's periodic inspections of the fire protection program; test controls; control of nonconforming conditions; corrective action program;

fire protection records; and resolution of findings and recommendations from previous audits.

In reviewing the sampled fire protection audits, the areas evaluated, and the findings and recommendations, the team noted that the audits did not routinely evaluate the design basis for the fire protection program, specifically as it related to meeting the technical requirements of Appendix R to 10 CFR Part 50. The team could not verify if the audit program evaluated the following areas: design-basis reverification of plant fire protection features; reverification of fire-induced electrical fault evaluation and the electrical engineering aspects of Appendix R (e.g., fuse breaker coordination, common enclosure, spurious equipment operations); reverification of systems and logic used to support the safe shutdown methodology and the fire protection features for those systems; reverification and evaluation of operational implementation of the safe shutdown analysis; or the design review of major plant modifications for potential impact on the plant fire protection program and/or the plant safe shutdown analysis.

c. Conclusion

The team concluded overall that the fire protection program audits could be improved by increasing the depth and scope of the evaluation of the plant's fire protection licensing and design basis and the plant's compliance with Appendix R. The team identified this as a program weakness, Failure of fire protection audits to evaluate the plant's compliance with Appendix R to 10 CFR Part 50.

F6 Miscellaneous Fire Protection Issues

F6.1 Post-Fire Safe Shutdown Capability

F6.1.1 Systems Reauired to Achieve and Maintain Post-Fire Safe Shutdown CaDabilitv

a. Inspection Scope

The team reviewed the licensee's post-fire safe shutdown methods to determine if the systems defined for use to achieve and maintain safe shutdown conditions satisfied the reactor performance goals established by Appendix R to 10 CFR Part 50.

b. Observations and Findings

The systems used to achieve post-fire safe shutdown are required by Appendix R to 10 CFR Part 50 to be capable of achieving the following performance goals:

- Reactivity control capable of achieving and maintaining cold shutdown reactivity conditions (~ c 0.99 and reactor coolant system (RCS) temperature less than or equal to 200 'F).

- During the post-fire shutdown, the RCS process variables shall be -maintained within those predicted for a loss of normal ac power, and the fission product boundary integrity shall not be affected (i.e., there shall be no fuel clad damage, rupture of any primary coolant boundary, or rupture of the containment boundary).

- Reactor coolant makeup capable of maintaining water level above the top of the core for boiling water reactors (BWRS).

- Process monitoring capable of providing direct readings to perform and control the above functions.

- Supporting functions capable of providing process cooling, lubrication, etc., necessary to permit operation of the equipment used to achieve safe shutdown.

During the accomplishment of the above shutdown performance goals, equipment, and systems used to achieve and maintain hot shutdown conditions are required to remain free of fire damage. Repairs (e.g., lifting of leads, installation of jumpers, or replacement of fuses) of systems necessary to achieve and maintain hot shutdown conditions are not allowed by the regulation. For equipment and systems used to achieve and maintain cold shutdown conditions, repairs are permissible. However, the extent of these repairs is constrained by the amount of time available for them to be accomplished. Specifically, for plant areas which will not require control room abandonment and implementation of an alternative shutdown capability, cold shutdown systems must be capable of being repaired within 72 hours. For areas where implementation of an alternative shutdown capability may be necessary, fire damage must be limited to allow repair of the cold shutdown systems and achievement of cold shutdown conditions within 72 hours.

Safe shutdown is defined by SESS as the successful accomplishment of the following plant conditions:

- <u>Hot Shutdown</u>: The reactor coolant system temperature is greater than 200 'F, — is less than or equal to 0.99, the reactor coolant makeup function is capable of maintaining reactor coolant level above the top of active fuel, reactor decay heat is being removed at a rate approximately equal to its generation rate, and the reactor mode switch is in the shutdown position.

- <u>Cold Shutdown</u>: The reactor coolant system temperature is equal to or less than 200 "F and — is less than 0.99.

- —— = The transient condition between hot and cold shutdown where heat removal exceeds heat generation.

The following paragraphs provide a detailed evaluation of the licensee's approach to meeting the post-fire safe-shutdown performance goals described above, as referenced in the licensee's SSA Criterion EC-013-0843, Rev. 1.

Reactivity Control Function

The reactivity control function is accomplished by the hydraulic insertion of control rods resulting from a manual reactor scram that is initiated by arming and depressing all four manual scram push buttons for reactor protection system (RPS) Divisions 1, 2, 3, and 4, located on MCR panels 1 C201 and 2C201 for Unit 1 and Unit 2, respectively. The reactor can also be manually scrammed from outside of the MCR by stopping either RPS motor-generator set, A or B on both units.

Reactor Pressure and Coolant System Inventory Control

The licensee's SSA utilizes three distinct shutdown paths, designated Paths 1, 2, and 3. For Paths 1 and 3, the core spray system (CSS) is used in conjunction with Automatic Depressurization System (ADS) for reactor pressure and coolant system inventory control. For the majority of fire areas, PP&L does not credit the availability of the normal offsite power source. Therefore, since fire may cause a loss of offsite power, both units may have to be shut down simultaneously. In this case, either HPCI or RCIC would be utilized for reactor coolant makeup purposes in the non-fire-affected unit. Path 2, which " utilizes either RCIC or the RHR system operating in the low pressure core injection (LPCI) mode in conjunction with ADS, is only used for shutdown from outside the MCR. HPCI and RCIC normally take suction from the condensate storage tank (CST). If the CST inventory were expended, the suction would be realigned to the suppression pool. CSS and RHR operating in the LPCI mode take suction only from the suppression pool. A minimum of one SRV is required to reduce reactor pressure during cooldown when using RCIC or HPCI. To rapidly reduce reactor pressure, a minimum of nine SRVS are available to support CSS or LPCI operation, six of which can be operated from the upper and lower relay rooms. Air to operate individual SRVS is stored in their respective air accumulators.

Reactor Overpressure Protection Function

Reactor overpressure protection function is accomplished through the SRV system. The self-actuating SRVS are located on the four main steam lines upstream of the inboard main steam isolation valves (MSIVS). When the SRVS are opened, they reduce reactor pressure by venting steam directly to the suppression pool. At SESS, there are 16 SRVS, and all are available to perform this function.

Decay Heat Removal Function

For alternate shutdown Path 2, reactor decay heat is removed by the self-actuating mode of SRV operation. Specifically, during high pressure isolation operation, decay heat is removed from the reactor through the SRVS with the suppression pool as a heat sink, using the RHR suppression pool cooling mode (hot shutdown) and the RHR normal shutdown cooling mode of operation (cold shutdown). The RCIC system is only credited for maintenance of coolant inventory. While some of the decay heat will be transferred from the vessel to the suppression pool through the RCIC pump turbine exhaust line, the amount of decay heat removed is significantly less than the total decay heat generated in the reactor core. As a result, the remainder of the decay heat must be transferred to the suppression pool through operation of the SRVS. The RHR and residual heat removal service water (RHRSW) systems then transfer the decay heat from the suppression pool to the ultimate heat sink. Since the RCIC system cannot complete the entire function of transferring the decay heat load to the ultimate heat sink, it is not credited as a decay heat removal system. During cold shutdown, decay heat removal is achieved by utilizing the normal shutdown cooling mode, i.e., the RHR system injecting directly to and from the reactor pressure vessel together with the RHRSW system cooling the RHR heat exchanger.

For Paths 1 and 3, reactor decay heat is transferred after a reactor scram to the suppression pool by depressurizing the reactor vessel, using the ADS. Reactor coolant makeup is provided by different divisions of core spray while the reactor depressurization function is provided by the ADS valves. The suppression pool is then cooled using the suppression pool cooling mode of RHR with one loop of suppression pool cooling for each path. If cooldown of the RPV is required but cannot be accomplished using normal shutdown cooling, alternate shutdown cooling is used in conjunction with the CSS and ADS. To enter alternate shutdown cooling, primary and secondary containment must be established (i.e., the reactor head vents, the MSIVS, and the main steam line drain lines must all be closed). During cold shutdown, decay heat removal is achieved by utilizing the normal shutdown cooling mode, with the RHR system injecting directly to and from the reactor pressure vessel and RHRSW cooling the heat exchanger.

Plant Monitoring and Instrumentation Function

In NRC Information Notice 84-09, the NRC identified the minimum instrumentation considered necessary to achieve safe shutdown for BWRS: reactor vessel water level and pressure, suppression pool level and temperature, level indication for all tanks used, and any diagnostic instrumentation for shutdown systems required for operability. At SESS, both suppression pool temperature and level may be monitored at the remote shutdown panel. However, in the event of a control room fire there is a potential for loss of both divisions of suppression pool temperature and level indication. If both divisions of suppression pool temperature indication at the remote shutdown panels fail, suppression pool temperature may be inferred from suppression chamber atmosphere temperature and atmosphere pressure indication, which are also available at the remote shutdown panel. Because the chamber remains at a relatively constant volume, the pool heatup or cooldown rate can be related to these two parameters. This deviation (Deviation Request No. 2) was previously reviewed and approved by the staff in a safety evaluation dated August 9, 1989.

For Paths 1 and 3, which consist of redundant Divisions 1 and 2, respectively, of the ADWCSS method, the reactor is scrammed on either high reactor pressure or low water level by the nuclear boiler instrumentation. The high pressure scram protects the RPV on high pressure and maintains the potential suppression pool temperature within acceptable limits. The low water level scram ensures integrity of the fuel rods. In addition, for Paths 1 and 3, reactor vessel makeup on low reactor water level must occur automatically. Reactor water level instrumentation provides the ADS/CSS initiation. Pressure instrumentation is required to permit core spray initiation at lower pressure. In the event that a fire in the upper or lower relay room disables the low pressure permissive for core spray operation, the permissive can be bypassed in the control room.

Safe Shutdown Support Functions

Support functions either remove heat or supply power to the process systems performing the shutdown functions of reactivity control, reactor coolant makeup, reactor depressurization, and heat removal. The RHRSW system removes heat from the suppression pool during operation of RHR in the suppression pool cooling mode and removes heat directly from the reactor loop through the RHR heat exchanger during operation of RHR in the shutdown cooling mode. The emergency service water (ESW) system provides equipment cooling through the appropriate room coolers in the reactor building. ESW also provides cooling to the control building heating, ventilation, and air conditioning (HVAC) system, which is required for equipment cooling in the control building structure. Electrical power is supplied by the diesel generators and the batteries to the various components through the ac and dc distribution systems.

Based on a review of the SSES SSA, the team selected a sample of required safe shutdown equipment for detailed evaluation. The objective of this evaluation was to assure that the equipment design, layout, and post-fire safe shutdown analytical approach met the technical requirements of Appendix R.

Adequacy of Suppression Pool Cooling During Simultaneous Dual Unit Shutdown

In the licensee's SSA, it is stated that a fire outside the MCR also results in a LOOP. This may leave only two RHR pumps on the same channel available for both units. In this case, because of emergency diesel generator loading restrictions, interlocks prevent the operation of the two RHR pumps on the same channel. As a result, only one unit at a time can operate in the suppression pool cooling (SPC) mode. Pool cooling can only be provided for both units by alternating operation of SPC between the two units (staggered operation). The team was concerned that this operating methodology may cause the suppression pool temperature limit to be exceeded. The team reviewed EC-059-0545, Rev. O, dated December 27, 1994, which analyzed the plant response for this situation. The calculation assumes one unit is placed in SPC mode within 10 minutes after its suppression pool temperature reaches 90 'F. After 5 hours, SPC is terminated on that unit and switched to the other unit. After 2 hours, it is returned to the first unit. Staggered operation with 2 hour on/off cycles are continued until. either equipment becomes available to allow dual unit SPC operation or cold shutdown conditions are achieved. The team found that neither unit exceeded the maximum pool chamber design temperature of 220 'F. Additionally, since the bounding assumptions for decay heat rate and RHR heat exchanger efficiency were conservative, the team felt that the actual SPC on/off cycles could be longer than assumed in the calculation and that longer cycles could readily be incorporated in the safe shutdown procedure..

Potential for Water Hammer in RCIC, HPCI, CSS, and RHR During LOOP Conditions

NRC information Notice (IN) 87-10 describes a water hammer event which occurred during a LOOP at a licensee's plant. Because of elevation differences, portions of the RHR system piping were voided through draindown to the suppression pool. SSES Procedure ON-037-001 states that the CTS or other method of maintaining keepfill is required for HPCI, RCIC, CSS, and RHR to prevent water hammer in the discharge piping. The need for keepfill pressure to be above 50 psig is stated in each of the above system's operating procedures (i.e., OP-149-001 for RHR and OP-1 51-001 for CSS), which are part of the licensee's symptom-based procedures for safe shutdown. This procedure also states that if discharge loop pressure in any of these systems drops below 50 psig, the equipment should be declared inoperable.

The CTS, and the cross-tie to the demineralized water system alternative keepfill scheme are not powered from a 1 E bus, which would make them unavailable during a fire event that causes a LOOP Since normal methods of maintaining keepfill were not credited by SSES for post-fire safe shutdown, the team noted that the loss of this capability may result in excessive water hammer in required shutdown systems. To preclude such an occurrence, PP&L has developed an alternate keepfill scheme which involves the installation of a temporary cross-tie, using a hose to supply water from the fire water system to the CTS. Since this scheme involved manual actions with staged equipment, the licensee was asked to demonstrate the scheme's feasibility. During the team's walkthrough of the procedure, tools and equipment required to make the connection between the CTS and the fire water system were not available. Additionally, the team noted that the emergency lighting in the area where that actions were to be performed did not appear to be sufficient.

As an immediate corrective action in response to the team findings, the licensee issued a Condition Report (CR) to correct identified deficiencies and establish a more effective method of providing keepfill in the long-term. As an interim compensatory measure, until a long-term resolution can be developed and implemented, PP&L will reevaluate the procedures involving the temporary connection to the fire water system and ensure appropriate tools and equipment are properly staged and dedicated for use. Potential long-term corrective actions described by PP&L included a modification to assure the availability of keepfill in the event of fire or loss of offsite power, and/or the addition of required keepfill pressure instruments to the Appendix R safe shutdown component list and/or performance of an analysis which demonstrates that ECCS systems can adequately perform their functions for Appendix R fires without keepfill.

Purging of the Main Generator/Exciter Hydrogen Cooling During a Loss of Offsite Power

Procedure E.O.-I 00-030 (symptom-based response to station blackout (SBO)) makes provisions to vent hydrogen from the main generator before shedding the turbine generator emergency seal oil pump. The licensee stated that this pump is powered from the 250V dc bus and was required to be shut down to ensure a 4-hour capacity for the 250V dc batteries. Having this pump shut down during a LOOP without purging would result in a release of hydrogen to the turbine building. To determine if the release " of hydrogen would create a fire hazard in the turbine building, the licensee has performed a calculation (EC-013-1057, "Turbine Building Hydrogen Concentration After Loss of the Generator Seal Pump," Rev. O, dated October 31, 1997), which the team reviewed. Calculation results showed that if all of the hydrogen in both of the main generators were released to the turbine building, the concentration, by volume, would be approximately 1.3 percent, which is sufficiently less than the flammability limit of 4 percent. The team found that the calculation assumed that the building ventilation system was isolated and that all the hydrogen in the generator leaked into the turbine deck atmosphere instantaneously. Based on its review, the staff found the calculation sufficiently conservative to justify not requiring the seal pump for safe shutdown.

Capability to Maintain Reactor Coolant Level Above Top of Active Fuel

Appendix R specifies that a plant have sufficient post-fire safe shutdown capability to maintain the reactor water level above TAF. The licensee was granted a deviation (No. 33) to use the ADS/CS shutdown methodology (rapid reactor depressurization and the use of low pressure core spray for reactor inventory makeup to achieve cold shutdown) in lieu of using an RCIC/HPCI high pressure methodology which can achieve and maintain hot shutdown conditions. The NRC based its acceptance of this method on the licensee's claim that this low pressure methodology did not to allow the RPV water level to go below TAF. In EC-013-0843 (pg. 70), the licensee stated that spurious SRV opening from fire-related damage could cause the RPV water level to go below TAF. Additionally, in calculation EC-013-0509, "Minimum Reactor Water Level Under Spurious SRV Operation During a Control Room Fire," Rev. 1, dated July 7, 1994, the licensee did a thermal-hydraulic analysis and found that the spuriously opening of 1 or 2 SRVS would cause the RPV water level to go below TAF. A subsequent thermal-hydraulic analyses, EC-THYD-1 035, "in-Shroud Level Response for a Boildown Transient with ADS at TAF," Rev. O, dated October 20, 1997, was performed by the licensee to address this concern. Results showed that if no SRVS actuated spuriously, the core would remain covered with a two-phase mixture inside the shroud. The calculation was terminated when the vessel pressure reached the shutoff head of the core spray pumps (280 psig). In reviewing this calculation, the team asked the licensee about the impact of spurious SRV actuation on the water level and the impact of void collapse on water level if vessel injection was required. Additionally, kinematic choking could be a concern if multiple SRVS actuated spuriously.

The licensee is considering changing the designation of this shutdown path to "alternative shutdown" in accordance with Appendix R, Section 111. L. According to the licensee, most plant areas where redundant safe shutdown circuits are located are protected by fixed suppression and detection systems.

c. <u>Conclusion</u>

Based on its audit of the licensee's post-fire safe shutdown analysis, the team concluded that the analysis adequately addressed suppression pool cooling during fire conditions which require the simultaneous shutdown of both units and the-conditions resulting in the loss of hydrogen from the main generator/exciter during a fire that results in the loss of off-site power.

SSES Operating Licenses NPF-14 (Unit 1) Condition 2.C (6) and NPF-22 (Unit 2) Condition 2.C(3) specify that the licensee implement and maintain in effect all provisions of the approved fire protection program as described in the FPRR for the facilities and as approved by the NRC SER dated August 9, 1989. The NRC based its approval of the SSES fire protection program on the licensee's commitment to follow the guidance of Appendix A to BTP APCSB 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants," and the licensee's commitment to meet Sections 111.G, 111. J., and 111.L of Appendix R to 10 CFR Part 50.

Section 111.G.1. of Appendix R to 10 CFR Part 50, states: "Fire protection features shall be provided structures, systems, and components important to safe shutdown. These features shall be capable of limiting fire damage so that (a) one train of systems necessary to achieve and maintain safe shutdown conditions from the main control room or emergency control station(s) is free of fire damage, and (b) systems necessary to achieve and maintain cold shutdown from either the control room or emergency control station(s) can be repaired within 72 hours."

Section 111. L.2.e of Appendix R to 10 CFR Part 50 specifies that "the supporting functions shall be capable of providing process cooling, lubrication, etc., necessary to permit the operation of equipment used for safe shutdown functions."

The team concluded that as of November 7, 1997, the licensee could not adequately demonstrate the CTS or other method of maintaining keepfill pressure above 50 psig to prevent water hammer in the HPCI, RCIC, CSS, and RHR discharge piping. In the event a fire that results in a loss of offsite power, the alternative keepfill schemes are not powered from a 1 E bus, which would make them unavailable during a LOOP, and the normal methods of maintaining keepfill are not credited by SSES for post-fire safe shutdown and, therefore may not be available to support post-fire safe-shutdown in the event of a control room fire. To preclude such an occurrence, PP&L has developed an alternate keepfill scheme which involves the installation of a temporary cross-tie, using a hose to supply water from the fire water system to the CTS. This scheme involved manual actions with staged equipment, and the team found that the tools and equipment needed to make the connection between the CTS and the fire water system were not available. The team has identified this as an unresolved item, Post-fire safe shutdown methodology does not assure availability of keepfill system to prevent water hammer in the HPCI, RCIC, CSS, and RHR system discharge piping. (Unresolved Item, 50-387, 388/97-201-02)

Section 111.L. 1.e of Appendix R to 10 CFR Part 50 specifies that "during the post-fire shutdown the reactor coolant system process variables shall be maintained within those predicted for a loss of normal ac power, and the fission product bounda~ integrity shall not be affected." In addition, Section 111. L.2.b of Appendix R to 10 CFR Part 50 specifies "the reactor coolant makeup function shall be capable of maintaining the reactor level above the top of the core for BWRS."

The licensee was granted a deviation to use of ADS/CS shutdown methodology in lieu of an RCIC/HPCI high pressure methodology. The acceptance of this method was based on the licensee's claim that this low pressure methodology did not to allow the RPV water level to go below TAF.

The team concluded that as of November 7, 1997, the licensee could not adequately demonstrate that the reactor coolant system process variables would be maintained within those predicted for a normal loss of ac or that the reactor water level would be maintained above the top of the core. In engineering calculation EC-013-0843 (pg. 70), the licensee stated that spurious SRV opening from fire-related damage could cause the RPV water level to go below TAF. Additionally, in calculation EC-013-0509, "Minimum Reactor Water Level Under Spurious SRV Operation During a Control Room Fire," Rev. 1, dated July 7, 1994, found that for the spuriously opening of one or two SRVS could cause the RPV water level to go below TAF. This is identified as an unresolved item, Failure of the automatic depressurization system/core spray (ADWCS) post-fire safe shutdown methodology to meet the Appendix R reactor performance goals by maintaining the reactor water level above the top of active fuel. (Unresolved Item 50-387, 388/97-201-03)

F6. 1.2 Separation of Post-Fire Safe-Shutdown Functions

a. Inspection Scope

Section 111.G of Appendix R to 10 CFR Part 50 specifies, in part, that in the event of fire in any plant area, one train of systems necessary to achieve and maintain hot shutdown conditions remain free of fire damage.

On a sample basis, the team evaluated the adequacy of separation provided for power, control, and instrument cabling associated with redundant trains of equipment relied on to accomplish required post-fire shutdown functions. The evaluation focused on systems, components, or functions required to achieve and maintain hot shutdown conditions', and included cables associated with components of the RHR, RHRSW, RCIC, reactor vessel wide range level instrumentation, and ESW. Table 1 lists the specific components selected for review and summarizes the evaluation results.

b. Observations and Findings

The adequacy of separation provided for required safe shutdown functions was determined from cable routing information retrieved from the SSES computerized cable routing management system, and the color-coded cable tray and conduit routing drawings prepared by the licensee, and the post-fire safe shutdown compliance strategies and separation analyses documented in the SSES Safe Shutdown Compliance Manual (calculation EC-01 3-0843, Rev. 2, dated May 27, 1997). This review identified plant areas where cables of redundant trains "interacted." For the purpose of this review, the team identified an interaction whenever cables of redundant shutdown paths and/or divisions were shown on the cable routing data and cable tray routing drawings as being in the same fire area or zone. The team then evaluated the licensee's evaluation of the interaction and its methodology for providing an acceptable resolution. This evaluation included areview of thepost-fire safe shutdown analysis and supporting calculations to determine if the interactions had been properly identified and dispositioned.

c. Conclusions

The team concluded, for the sample of circuits selected, that the level of protection provided for redundant trains of post-fire shutdown systems satisfied the technical requirements of Section 111.G of Appendix R to 10 CFR Part 50.

F6. I.2 Operability of Post-Fire Safe Shutdown Capability

a. Inspection Scope

During the onsite inspection, the team audited how the licensee assured that the systems required for safe shutdown remained operable and available. The team reviewed the maintenance periods and the surveillance testing performed. A representative sample of the licensee's administrative controls related to safe shutdown system configuration was inspected. Primary emphasis was placed on how operations would implement safe shutdown, particularly outside the MCR, when a required system or train was manually isolated for maintenance purposes or surveillance testing.

b. Observations and Findings

During a plant walkdown the team observed the equipment to be well maintained, with the proper labeling clearly visible. Required locking devices were in place, and the plant piping was consistent with pipe and instrument drawings (P&ID), the in-plant operational configuration of safe shutdown equipment, and the SSA. The inspection included verification that HV-I 51 FO1 OA and HV-151 FO1 OB had their power removed to prevent flow diversion and HV-I 51 F122A and HV-I 51 F122B had their hand wheels removed to prevent primary containment override. Subsequent questions asked of operations personnel about administrative control of Appendix R-required equipment revealed that systems required for safe shutdown were mainly controlled by TS Limiting Conditions for Operation (LCO) and, therefore, had adequate compensatory measures in place. During these discussions with operations, the team identified a weakness concerning safe shutdown from outside the MCR, in that the operators would have to rely on memory to ascertain the equipment status under their control when exiting the MCR. The licensee stated that it would consider placing a statement in the safe shutdown procedures recommending that the shift turnover logs or similar equipment status documents be taken with the operators when evacuation of the MCR is necessary.

c. Conclusion

Based on a limited review , the team concluded the licensee had sufficient controls in place to verify the operability and availability of post-fire safe shutdown capability. This aspect of the licensee's program was found to be adequate.

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c. Conclusions

The team concluded, for the sample of circuits selected, that the level of protection provided for redundant trains of post-fire shutdown systems satisfied the technical requirements of Section 111.G of Appendix R to 10 CFR Part 50.

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c. Conclusion

Based on a limited review , the team concluded the licensee had sufficient controls in place to verify the operability and availability of post-fire safe shutdown capability. This aspect of the licensee's program was found to be adequate.

F6. I.4 Alternative Post-Fire Safe Shutdown Capability

a. Inspection Scope

Based on a review of the SESS SSA, the team selected a sample of required safe shutdown equipment for detailed evaluation. The objective of this evaluation was to assure the equipment design, layout, and post-fire safe shutdown analytical approach complied with the Appendix R requirement that one train of systems needed to achieve and maintain safe shutdown conditions from outside the MCR be free of fire damage.

b. Observations and Findings

In the licensee's SSA, the CST level instrumentation was not identified as required for safe shutdown. Since the alternative shutdown methodology requires RCIC for reactor water level control and since the shutdown procedures state that, if the suppression pool water temperature exceeds 1400 F, RCIC suction should be switched to the CST, the operator would be unaware if there was an insufficient water inventory in the CST, switch RCIC to the CST and, due to insufficient net positive suction head (NOSH), potentially damage the pump. Additionally, when the transfer switch is activated at the remote shutdown panel (RSP), the automatic swap of RCIC to the suppression pool on low CST level is bypassed. The licensee stated that the CST level instrumentation is not required for safe shutdown and that local level indication is available at the CST and could be checked periodically or before swapping the RCIC suction source, and that if there were insufficient water inventory the operator could proceed to repressurize the vessel and use RHR in the alternate shutdown cooling mode. The licensee also stated that given the minimum technical specification limit on CST water inventory and a 50 gpm leak rate through the recirculation pump seals, there was sufficient water in the CST to achieve cold shutdown.

c. Conclusion

The team concluded that PP&L has demonstrated that sufficient controls to ensure adequate water inventory in the CST have been established. Additionally, in the event CST level monitoring is desired during the post-fire shutdown scenario, local level indication is available at the CST. Based on these findings, the team's concern regarding the lack of CST level instrumentation at the RSP was resolved.

F6. I.5. Associated Circuits

a. Inspection Scope

Section 111.G of Appendix R to 10 CFR Part 50 specifies, in part, that associated non-safety circuits and cables that could prevent operation or cause maloperation of structures, systems, and components important to safe shutdown, be provided with a level of fire protection necessary to ensure such circuits will remain free of fire damage. Acceptable options for providing this level of fire protection are delineated in Section 111.G.2 of Appendix R.

By letter dated February 20, 1981, the staff issued Generic Letter (GL) 81-12. This GL, and its subsequent clarification letter, dated March 22, 1982, provide the principal staff guidance regarding potential configurations of associated circuits of concern to post-fire safe shutdown capability. Additional guidance and evaluation criteria have also been provided by the staff in several INs (e.g., INs 84-09, 85-09, 92-18), and GL 86-10. As described in these documents, associated circuit configurations of concern to fire safety include:

- circuits which share a common power supply (e.g., switchgear, motor control center (MCC), fuse panel) with circuits of equipment required to achieve safe shutdown

- circuits which share a common enclosure, (e.g., raceway, conduit, junction box, etc.) with cables of equipment required to achieve safe shutdown

- circuits of equipment whose spurious operation or maloperation may adversely affect the successful accomplishment of safe shutdown functions

During this inspection, the potential effect of fire on each associated circuit configuration described above was evaluated on a sample basis. The sample included power, control, and instrument circuits and cables. The team evaluated potential fire-initiated problems based on an evaluation of components and equipment selected by the licensee to achieve the safe shutdown performance goals described in its post-fire safe shutdown analysis.

b. Observations and Findinas

Circuits Associated bv Common Power Supply

The common power supply associated circuit concern arises when nonessential equipment shares a common power supply (switchgear, MCC, distribution panel, etc.) with equipment required to perform a safe shutdown function. In the absence of adequate fire protection features (per Section II 1.G.2 of Appendix R) or electrical coordination (selective tripping), fire-initiated faults on nonessential branch/load circuits of a required power supply may propagate to trip the upstream feeder protective device (i.e., circuit breaker, relay, fuse, etc.) to the supply before the individual branch/load protective device, thereby causing a loss of electrical power from the supply.

To address this concern, PP&L had performed an evaluation to demonstrate that fire-induced faults on nonessential circuits of a required power supply would not affect the post-fire safe shutdown capability of the plant. The results of this evaluation were documented in PP&L calculation EC-004-0501, Rev. 11, dated February 25, 1997.

The team evaluated the adequacy of protection provided for power supplies of equipment relied on to achieve post-fire safe shutdown conditions. The evaluation consisted of verifying selective coordination between the supply breaker or fuse and the load breakers or fuses for a sample of power sources required for post-fire safe shutdown. This evaluation was based on a review of protective device time/current characteristic. The results of the evaluation are summarized below

Common Power Supply - Review Results

Voltage Level	Required Power Source	Fault Protection
4.16kV	ES 4kV Switchgear (Div 2) - 1A202	Acceptable
480V ac	ES Load Center Channel B -1 B220	Acceptable
	ES Load Center Channel D - 1B240	Acceptable
125V dc	Distribution Panel U1/Div 2-1 D624	Acceptable
	Distribution Panel U2/Div 2-2D624	Acceptable

The power supplies selected for review were found to be provided with sufficient levels of protection to address post-fire safe shutdown concerns. Specifically, the power supplies selected for review had (a) an acceptable level of selective coordination between electrical protective devices, or (b) suitable levels of fire protection and/or separation (e.g., fire barrier wrap, length of cable between a fire-induced fault and the protective device) necessary to achieve selective coordination under fire conditions, or (c) a redundant power supply available to support post-fire safe shutdown functions (i.e., a power supply lacking sufficient overcurrent fault protection was not credited for safe shutdown in areas where the load cables were routed). Based on the results of this review, the coordination or selective tripping capability of power supplies relied on to achieve and maintain safe shutdown was found to be acceptable.

High Impedance Faults

Circuit breaker or fuse coordination is evaluated to demonstrate that bolted (low impedance) faults on individual load circuits will not affect the operability of power sources required for post-fire safe shutdown. As a result of certain fire damage conditions, however, the fault current experienced by load cables of a required power source may not always result in a bolted, low impedance, fault which would be expected to yield maximum values of fault current. Depending on the extent of cable damage and other contributing factors which may be unique to a particular cable configuration, the actual value of fault current experienced may be below the trip setting of the individual branch breakers or fuses of the affected power source. On an individual basis, such low magnitude (high impedance) faults would not typically be of concern to post-fire safe shutdown. However, if a sufficient number of branch circuits failed in this manner, the additive fault currents, when combined with the running bus current, could trip the supply (feeder) breaker or fuse for the bus. This would result in a loss of power to the safe shutdown loads powered from the bus. To meet the separation requirements of Appendix R Section 111.G.2, the evaluation of electrical power supplies required for post-fire safe shutdown must also consider the potential for fire to cause multiple, simultaneous high impedance faults on all branch circuits that may be exposed to fire (ref. GL 86-10, Section 5.3.8). The objective of this evaluation is to provide assurance that the loading effect of high impedance faults that may occur as a result of fire, when combined with the normal bus load current, will not result in a trip of the feeder breaker or fuse to a required power source.

PP&L had performed a comprehensive evaluation of this concern as part of its circuit coordination study (calculation EC-004-0501). This analysis considered all multiple high impedance faults (MHIFs) that may occur as a result of fire in a given fire zone, It should be noted that this approach differs from staff guidance presented in Section 5.3.8 of GL 86-10 (which states that the evaluation should be performed on a "fire area" basis). However, since the staff has accepted similar evaluation approaches developed by other operating plants, the team found the licensee's approach to provide suficient assurance that fire-induced MHI Fs would not affect the post-fire safe shutdown capability of SSES. Specifically, as the staff stated in its safety evaluation (dated April 12, 1989) of the PP&L analysis of MHIFs, it is considered highly unlikely that all unprotected cables of a required power supply would be simultaneously faulted in a high impedance condition *for an extended period of time.* Based on a review of plant-specific features and the PP&L methodology for defining fire areas and fire zones, the inspection team deemed not credible the possibility that simultaneous faults occurring in one fire zone at SSES might be sustained at a high impedance level (without propagating to a low impedance, bolted, fault) for sufficient time to allow the fire to traverse to another fire zone. On this basis, the inspection team concluded that the licensee's method of evaluating all potentially affected circuits in a given fire zone at a high impedance fault current level is sufficiently conservative to satisfy the intent of the guidance presented in Section 5.3.8 of GL 86-10.

As a result of its analysis, PP&L identified cases where MHIFs on the load circuits of a power source required for post-fire safe shutdown could the supply's feeder breaker. PP&L performed an evaluation of each case to determine its potential effect on the plant's post-fire safe shutdown capability. For each fire zone where load cables of required power sources (i.e., redundant power sources identified on the SSES Appendix R Safe Shutdown Component List, Drawing No. M-1002, Rev. 5, dated August 19, 1997) were located, PP&L determined if MHIFs could impact the bus from which the cables were fed. For cases where a power source was credited to power shutdown equipment in the event of fire in a given fire area, and MHIFs occurring as a result of fire could affect the availability of the credited power supply (i.e., MHIFs could affect the bus plus the bus required for safe shutdown), PP&L implemented methods of resolution.

To evaluate the adequacy of the analysis performed and method of resolution implemented, the team reviewed the PP&L compliance strateg-y developed for Fire Area CS-1 O (Unit 1 upper cable spreading room).' This area is comprised of two fire zones (0-27C and O-27D) and was selected because it credits the availability of Division II components (Shutdown Path 3). Fire Zone O-27C was found to contain load cables associated with the Division II 125V dc distribution panel (panel 1 D624). The team determined that the PP&L analysis had appropriately identified potentially affected cables and found acceptable the PP&L resolution, which credits existing fire barriers (e.g., fire barrier wrap) to prevent MHIFs from affecting the safe shutdown capability.

Based on the review of SSES calculations, fire area compliance strategies and protection features (1-hour fire barriers) installed to protect potentially affected circuits, the team found the licensee's method of protection for multiple high impedance faults acceptable.

The Spurious Sianals Associated Circuit Concern

Specific circuits of concern include those which have not been provided with a level of fire protection specified in Section III.G.2 of Appendix R to 10 CFR Part 50 and have a connection to equipment whose fire-induced spurious operation could prevent the operation or cause the maloperation of equipment, components, or systems required for post-fire safe shutdown. This concern principally comprises of two items:

1. the maloperation of required equipment due to fire induced damage to associated cabling (e.g., false motor, control, and instrument readings which may be initiated as a result of fire-induced grounds, shorts, or open circuits)

2. the spurious operation of safety-related or non-safety-related components that could prevent or cause the maloperation of the post-fire safe shutdown capability

Section III.G of Appendix R to 10 CFR Part 50 specifies, in part, that associated non-safety circuits and cables that could prevent operation or cause maloperation of structures, systems, and components important to safe shutdown be provided with a level of fire protection necessary to ensure such circuits will remain free of fire damage. Acceptable options for providing this level of fire protection are delineated in Section III.G.2 of the regulation.

As described in GLs 81-12 and 86-10, in lieu of one of the protection options contained in Section II 1.G.2 of the regulation, detailed circuit analyses may provide a suitable means of demonstrating that fire will not cause equipment to spuriously actuate in a manner that will affect the post-fire safe shutdown capability. With regard to the circuit failure modes that must be considered in identifying circuits associated by spurious operation, Section 5.3.1 of GL 86-10 provides the following guidance:

> Sections III.G.2 and III.L.7 of Appendix R define the circuit failure modes as hot shorts, open circuits, and shorts to ground. For consideration of spurious actuation, all possible functional failure states must be

evaluated, that is, the component could be energized or de-energized by one *or more* of the above failure modes... (emphasis added).

As part of its post-fire safe shutdown analysis (calculation EC-013-0843), PP&L performed a comprehensive analysis of equipment whose spurious operation could adversely affect, prevent, or cause the maloperation of the shutdown capability. If the licensee's analysis determined that multiple fire-induced circuit failures (e.g., faults) on cables or circuits located in the fire area could not cause a required safe shutdown component or system to spuriously actuate in a manner that would adversely affect, prevent the operation, or cause the maloperation of the post-fire safe shutdown capability, fire protection features would not be necessary and the component was omitted from further evaluation. PP&L identified equipment and components whose spurious operation could affect post-fire safe shutdown. PP&L then applied the following assumptions in its evaluation of the fire areas and zones where cables or circuits of these components were found:

1. More than one spurious actuation is possible. The effect of all potential spurious equipment operations that may occur as a result of fire in a given fire area were considered. The evaluation assumed multiple spurious actuations to occur and that they could all occur but not simultaneously.

2. All circuits and cables will experience fire damage unless provided with fire protection features specified in Section III.G.2 of Appendix R to 10 CFR Part 50.

3. When considering the effects of fire on unprotected cables and circuits, all possible cable and circuit failure modes were considered. These include hot shorts (i.e., an un-energized conductor or cable becomes energized by shorting to energized conductors of the same cable or other cables), short circuits, open circuits, and shorts to ground.

4. Unprotected cables may experience multiple concurrent faults (i.e., short circuits, open circuits, and shorts to ground). However, as stated in Section 5.3.1 of GL 86-10, the number of hot shorts that must be considered for each component being evaluated is limited to one, unless the component comprises a high-to-low pressure interface boundary.

5. Fire is not postulated to eventually clear the fault. Fire-initiated faults will persist until action is taken to negate their effects.

As part of the licensee's evaluation, all circuits which could cause undesirable spurious operations were identified and evaluated for potential fire damage. With the exception of components which comprise a high/low pressure interface boundary, the licensee's evaluation considered any and all spurious operations that may occur as a result of *a* single fire; however, they were not assumed to occur simultaneously. That is, for each fire area all potential spurious operations that may occur as a result of a postulated fire were identified, and appropriate corrective actions were implemented as needed. For redundant components which form a high/low pressure interface boundary the evaluation considered the potential for concurrent, simultaneous spurious operations.

When cables of equipment whose spurious operation could affect safe shutdown were identified, they were included in the licensee's Appendix R safe shutdown component list (Drawing M-1 002), and evaluated in the same manner as components required to achieve and maintain safe shutdown of the reactor in the event of fire. For all components on the safe shutdown component list, the cabling required for operation, or any cabling that could either directly or indirectly cause the maloperation of components required for post-fire safe shutdown, was identified.

On a sample basis, components whose spurious operation could adversely affect the post-fire safe shutdown capability were selected for review. This inspection focused on the adequacy of the licensee's analysis for fire to create a flow diversion path as a result of common-cause fire damage to multiple components. Specific components selected for review were RCIC flow-path valves HV-E51 -1 F022 and HV-E51-1 FOI 1 and RHRSW valves HV-21 2-1 F073B and HV-21 2-1 F075B. For each system, these valves are normally closed, series-connected, MOVS and were selected because fire-induced spurious operation of both valves may cause flow to be diverted from their respective systems.

From a detailed review of cable routing and fire area compliance strategies for the selected components, the inspection team concluded that PP&L had appropriately considered the potential for a single fire to cause multiple circuit failures which may lead to the spurious operation of multiple flow diversion components. Additionally, since these components do not comprise a high-to-low pressure interface boundary, PP&L had appropriately considered the potential for fire to cause spurious operation as a result of the various fire-induced circuit failure modes (e.g., hot shorts, short circuits, open circuits, shorts to ground).

To preclude flow diversion from the RCIC flow-path, RCIC valve HV-E51-1 F022 has been included on the Appendix R component list. Cables whose fire-induced damage may cause this valve to spuriously operate were found to be either outside the fire area(s) of concern (i.e., areas where operation of RCIC is credited) or appropriately protected with fire protection features specified by Section III.G.2 of Appendix R to 10 CFR Part 50. Since RCIC is credited to provide RPV makeup in the event of a control room fire, PP&L has provided isolation capability for valve HV-E51 -1 F022 at the remote shutdown panel via isolation transfer switch HSS-14903B.

With regard to RHR service water valves HV-21 2-1 F073B and HV-21 2-1 F075B, an inspector was concerned that the spurious opening of both valves because of a single fire could cause RHR service water to be diverted to the RHR system. This case would normally be precluded by the higher system pressures of the RHR system. However, during certain shutdown scenarios the RHR system may not be running when the RHR service water system is in service. From a detailed review of system flow-path drawings for the RHR and RHR service water systems and discussions with the licensee, it was concluded that all possible flow diversion paths created by the spurious opening of both

HV-21 2-1 F073B and HV-21 2-1 F075B are blocked by protected valves, check valves, or locked-closed valves.

After reviewing the licensee's circuit fault analyses methodology, component failure assumptions, and evaluation of equipment whose spurious operation could adversely affect post-fire safe shutdown, the team did not identify any potential fire-induced spurious signal conditions which would prevent the operation or cause the maloperation of post-fire safe shutdown components, equipment, or systems.

High/Low Pressure Interfaces

High/Low pressure interfaces exist where the high pressure RCS interfaces with systems designed to withstand lower operating pressures. In the event cabling associated with electrically controlled devices (such as motor-operated valves) used to isolate the primary coolant boundary is damaged by fire, there is a potential for an uncontrolled loss of reactor coolant into the low pressure system, thereby resulting in a fire-induced LOCA through the high/low pressure interface. Due to the potentially serious consequences of this event, the NRC has established more rigorous evaluation criteria for electrically operated devices which comprise a high-low pressure interface boundary. Specifically, cables and circuits of these devices must consider the potential for fire to cause multiple, simultaneous, hot shorts of the proper polarity without grounding.

PP&L has identified and evaluated all potential RCS interfaces which could result in a loss of RCS inventory. This evaluation was performed under Nuclear Engineering Calculation EC-01 3-0873, "Appendix R Evaluation of Flow Diversion and High/Low Pressure Interface Components," Rev. 1, dated September 18, 1996. The purpose of this study was to evaluate all potential flow diversion and high/low pressure interface flow paths and to identify those components that must be listed on the Safe Shutdown Components List (SSCL). Inclusion on the SSCL ensures that components and associated cabling are properly evaluated and protected in accordance with the separation requirements of Section III.G.2 of Appendix R and precludes a fire from having an adverse effect on the plant's ability to achieve and maintain safe shutdown.

As a result of its evaluation the licensee has identified the following interfaces as high/low pressure interfaces of concern:

- Interface: Reactor Head Vent Line Valves HV-141-F001 and HV-141-FO02

  This interface consists of two series-connected valves upstream of a 4" line which is designed for atmospheric pressure. Fire-induced spurious opening of both valves could cause an interfacing LOCA due to the low pressure rating of the downstream piping. To preclude this possibility, both valves are listed on the SSCL and protected from the effects of fire in accordance with Appendix R, Section III.G.2, to ensure one valve remains free of fire damage.

- Interface: Loop B Recirculation Suction Line to RHR (RHR shutdown cooling mode isolation valves), HV-151 -FO08 (outboard isolation valve), and HV-151 -FO09 (inboard isolation valve)

  Inboard and outboard RHR shutdown cooling mode isolation valves HV-151-FO08 and HV-151 -FO09 are normally closed MOVS that are arranged in series. Shutdown cooling is not a required mode of the RHR system for shutdown paths 1 and 3 (i.e., ADS/CS Division 1 and Division 2). Therefore, during implementation of these shutdown methods, valves HV-151-F008 and HV-151 -F009 are required to remain closed at all times (i.e., in the event of fire in areas outside the main control room). In the event of fire in the main control room (Fire Area CS-9) shutdown path 2 (RCIC controlled from the remote shutdown panel) is used. For shutdown path 2, valves HV-151 -FO08 and HV-151 -FO09 are required to remain closed until the RHR shutdown cooling pressure permissive is satisfied, after which the valves will be required to open to perform the RHR shutdown cooling function. To ensure operability of these valves for a fire in the control room that requires evacuation and shutdown from outside the control room at the remote shutdown panel, PP&L has provided isolation of both valves at the RSP of both units via transfer switches HSS-1(2)51 12B and HSS-1 (2)51 13A. To ensure at least one valve will remain free of fire damage in the event of fire in other plant areas, PP&L has identified fire areas and fire zones in which a fire could result in the spurious opening of both isolation valves (Reference: Engineering Calculation EC-01 3-0678, Rev. 1, dated September 11, 1996) and has ensured that in these areas the valves are provided with the fire protection features specified by Section III.G.2 of Appendix R.

- Interface: Loop A and Loop B Recirculation Suction Lines to RWCU HV-144-F001, HV-144-FO04, and HV-144-F033

  A branch line off the RWCU piping can direct RWCU water to either the main condenser or liquid radwaste collection and surge tanks. HV-144-F001 and HV-144-F004 are normally open during power operations to allow operation of the RWCU system. This line is isolated from the RWCU piping by either valve HV-144-F033 or parallel valves HV-144-F034 and HV-I 44-F035. The branch line piping upstream of valves HV-144-F034/F035 is designed for a maximum pressure of 1545 psig and the downstream piping is designed for a maximum pressure of 50 psig. Thus, the spurious opening of HV-44-001, FO04, and F033 and the opening of either HV-144-F034 or F035 could result in an interface LOCA. Isolation of HV-144-F001, FO04 or FO033 is necessary to ensure integrity of this interface. To preclude this occurrence HV-144-FOO1, FO04, and FO033 are listed in the SSCL and provided with the fire protection features specified by Section III.G.2 of Appendix R.

The licensee's identification and resolution of potential high/low pressure interfaces of concern to post-fire safe shutdown were found to be acceptable.

Protection From Potential Loss of Remote Shutdown Capability Due to Fire Induced Circuit Faults Prior to Isolation (Reference: NRC Information Notice 92-18)

The alternate shutdown system includes isolation/transfer switches to provide electrical isolation of safe shutdown components from the effects of fire in Fire Area CS-9. In addition to providing electrical isolation, the isolation/transfer capability also provides redundant fusing for safe shutdown components, thereby precluding the need to replace fuses following transfer. Once the isolation/transfer capability is actuated at the remote shutdown panels, RCIC will be available to provide high pressure makeup and RHR will be available for suppression pool cooling during hot shutdown. As RCS pressure is reduced to less than 98 psig, RHR will also be available for the shutdown cooling mode of operation.

As described in IN 92-18, there is a potential for fire-induced circuit failures (e.g., hot shorts) to occur in the control circuits of certain MOVS needed to shut down the reactor and maintain it in a safe condition prior to their isolation at the RSP. Since the faulted condition would bypass limit and torque switch protection, spurious valve operations could result in mechanical damage to the valve.

PP&L performed an evaluation (Calculation EC-013-0730) to identify potential MOVS susceptible to this failure mode. The identified valves, their associated post-fire safe shutdown system, and method of resolution are delineated in Table 2 to this report. As a result of this evaluation, PP&L has determined that RCIC system valves could be damaged as a result of the failure mode described in IN 92-18. However, should operability of the RCIC system be affected prior to isolation at the RSP, an alternate shutdown methodology, using low pressure injection systems (i.e., RHR in the LPCI mode) would be available at the RSP to accomplish post-fire safe shutdown. To ensure this capability, damage to RHR system valves is precluded by modifications necessary to support operation of RHR system for decay heat removal or low pressure makeup (e.g., wiring changes which electrically relocate torque and limit switches of required RHR system valves).

Based on the above, the PP&L disposition of valves potentially affected by the failure mode described in IN 92-18 was found to be acceptable.

<u>The Common Enclosure Associated Circuit Concern</u>

Fire-induced damage to nonessential circuits that are associated by common enclosure with circuits required to achieve and maintain safe shutdown may create circuit faults in electrically unprotected cables. In the absence of appropriate electrical overcurrent protection, such faults could be of sufficient magnitude to create secondary fires. If such secondary fires occurred in an enclosure which contained cables required for safe shutdown, the successful achievement of safe shutdown could be adversely affected.

During the inspection the team evaluated the adequacy of electrical protection provided for a sample of non-essential cables routed in common enclosure with cables required for post-fire" safe shutdown. This evaluation did not identify any instances 'where the rating of the electrical protective device (circuit breaker or fuse) was inappropriate for the cable it was intended to protect.

Based on the results of this review the adequacy of electrical protection provided for nonessential cables which share a common enclosure with cables of equipment required for post-fire safe shutdown was found to be acceptable.

c. Conclusion

On the basis of its review of the PP&L evaluation of circuit breaker, relay, and fuse coordination, related discussions with SSES engineering staff members, and the acceptable level of coordination and/or fire protection features found in a sample of circuits selected for review, the team did not identify any potential weaknesses in the licensee's method of protection from the effect of fire-induced, low impedance, bolted shorts in nonessential loads of required power supplies. Additionally, on the basis of its review of the licensee's evaluation and on electrical protection features provided, the team did not identify any weaknesses associated with the licensee's identification of, and method of protecting against, fire-induced MHIFs.

The team concluded that the licensee's criteria and analysis methodology for circuits of equipment whose spurious actuation could adversely affect the post-fire safe shutdown capability conformed to the guidance of GL 86-10. On the basis of its review, the team did not identify any weaknesses in the licensee's analysis and method of protection for fire-induced spurious equipment operations.

In addition, based on a its review of a sample of nonessential cable routed in a common enclosure with safe shutdown required circuits, the team concluded that the electrical protection provided was adequate and, therefore, no weaknesses were identified with the licensee's evaluation of the common enclosure.

F6.2 Operational Procedures and Operator Readiness

F6.2. 1 Post-Fire Safe Shutdown and Alternative Shutdown Capability Procedures

a. Inspection Scope

The team reviewed the licensee's symptom-based procedures to achieve post-fire safe shutdown conditions. Appendix R specific guidance is described in ON-013-001, "Response to A Fire," Rev. 6, dated April 25, 1997, and alternate shutdown procedures ON-1 00-009, "Control Room Evacuation," Rev. 4, dated April 18, 1997, and ON-200-009, "Control Room Evacuation," Rev. 5, dated April 18, 1997, for Units 1 and 2, respectively. Areas inspected included the ability to perform required safe shutdown actions in a timely manner and the technical adequacy of the actions sequence to meet predicted plant responses to them, as wail as the supporting calculations that establish the technical basis for the procedures.

b. Observations and Findings

The licensee's safe shutdown procedures are symptom based. The procedures listed above direct the operators to utilize other procedures, depending on the availability of equipment. These other procedures do not take into account the impact of fire damage, including the potential for fire-induced spurious signals on shutdown systems. For example, the normal shutdown procedures would not contain cautions on the possibility of hot shorts changing valve positions or potentially giving the operators false instrumentation readings. In reviewing the licensee's procedures for implementing a safe shutdown of the plant following a fire in plant areas not requiring MCR evacuation, the team found that preferred instrumentation and equipment that would be free of fire damage was not identified by the safe shutdown procedures on a fire area or fire zone basis, although this information was available in the licensee's SSA. Additionally, the procedures did not provide guidance regarding the manual operator actions which may have to be performed for a specific fire area or zone. Depending on the location of the fire, the licensee's SSA requires different manual actions to be performed for different fire areas. Many of the operator actions specified in Design Change Notice (DCN) 96-0117 (E-690), such as verification of valve position, were not found to be integrated into the safe shutdown procedures. Because the procedures do not identify preferred safe shutdown instrumentation, equipment, and manual actions, operators may lack potentially vital information required to safely shut down the plant and possibly make a operational decision based on erroneous information. For example, nonprotected instruments could be used to take shutdown actions that could complicate the shutdown process or mislead the operators or allow important valves to change position due to fire-induced circuit failures and not be accounted for by the operators in a timely manner because this information was not readily available in the shutdown procedures. An example of this concern is the lack of an action statement to ON-013-001 to direct operators directly to ON-149-001 and ON-249-001 to prevent water hammer in the event CTS is lost. The licensee agreed with the team's assessment.

In response to the inspection team's concern, the licensee issued Condition Report 97-3615, dated October 29, 1997, to require additional manual actions identified as a result of recent revisions to calculations EC-013-0843, Rev. 2, and EC-013-0859, Rev. 5, and any additional information about these actions to be incorporated into in the shutdown procedures.

c. Conclusions

The licensee's SSA states that certain manual operator actions maybe necessary to accomplish PFSSD in the event of fire within specific fire areas or zones other than the main control room (Fire Area CS-9) and identifies which reactor process monitoring instrumentation is free of fire damage and known to be reliable for use to support PFSSD operations.

SSES Operating License NPF-14 (Unit 1) Condition 2.C (6) and NPF-22 (Unit 2) Condition 2.C(3) specify that the licensee implement and maintain in effect all provisions of the approved fire protection program as described in the FPRR for the facilities and as approved by the NRC SER dated August 9, 1989. The NRC based its approval of the SSES fire protection program on the licensee's commitment to follow the guidance of Appendix A to BTP APCSB 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants," and the licensee's commitment to meet Sections III.G, 111. J., and III.L of Appendix R to 10 CFR Part 50.

Plant TS, Section 6.0, "Administrative Controls," subsection 6.8.1. requires written procedures to be established, implemented, and maintained covering the activities recommended in Appendix A of Regulatory Guide (RG) 1.33, Rev. 2, February 1978. Appendix A of RG 1.33 specifies that procedures for combating emergencies and other significant events be developed and implemented.

Contrary to the above, as of November 7, 1997, the licensee could not demonstrate that the off-normal and emergency operating procedures incorporated certain potentially critical SSA operational information (i.e., specific prescriptive manual operator actions and protected instrumentation) and identified to operators as critical actions necessary to achieve and maintain post-fire safe shutdown. The team has identified this as an unresolved item, Failure to identify preferred post-fire safe shutdown instrumentation and required post-fire safe shutdown actions in its procedures used for post-fire safe shutdown from inside the control room. (Unresolved Item 50-387, 388/97-201 -04)

F6.2.2 Alternative Post-Fire Safe Shutdown Procedure Walkdown

a. Inspection Scope

The team walked down ON-1 00-009, the licensee's alternative post-fire safe shutdown procedure, to verify manual operations could be performed in a timely manner consistent with the time line specified in the SSA. During the walkdown the team verified the checklist contained in the procedure was conducted by licensed operators, and watched operators implement the alternative safe shutdown capability without relying on hot-shutdown-related equipment repairs. In addition, the team reviewed the cold shutdown repair procedures described in IC-280-004, Rev. O, and IC-1 49-005, Rev. O. These procedures provide a means to re-establish temporary RPV level and RHR heat exchanger inlet and outlet reactor coolant temperature indications, respectively, and they were walked down to determine their feasibility.

b. Observations and Findings

Alternative shutdown procedures ON-1 00-009 and ON-200-009 direct operators to have instrument and control (I&C) technicians install temporary reactor level and RHR inlet and outlet temperature instruments. The licensee stated that the use of temporary instrumentation specified in the procedure, while desirable from an operational perspective, is not required to accomplish safe shutdown conditions. The licensee bases this position on the fact that instrumentation available to the operators is consistent with the information provided to the licensees in IN 84-09. Specifically, RPV level can be monitored by level indicator LI-1 (2)4262, which is available at the RSP.

With regard to the operators' capability to determine the achievement of cold shutdown conditions (RCS temperature), the licensee has provided this capability (defined as RCS temp. <212 "Fat saturated conditions) through use of reactor pressure indicator PI-1(2)4262, which is also located on the RSP.

The inspection team agreed with the licensee's position that the temporary instruments identified in the EOPS are not required to satisfy Appendix R requirements and failure to perform these activities would not preclude the ability of the operators to achieve and maintain safe shutdown conditions. However, from discussions with plant operators, it appears that the availability of these instruments is highly desirable and it is expected that operators would request plant I&C technicians to perform the repair activities as specified in the procedure.

During the inspection, activities involved in performing the specified repairs were reviewed and walked down with I&C technicians and other licensee representatives. All actions necessary to perform these activities were found to be governed by written procedures. Specifically, Nuclear Department Procedure IC-280-004, Rev. O, dated April 7, 1994, provides procedural guidance for the installation of reactor shutdown range level measurement equipment, and procedure IC-249-005 Rev. O, dated April 7, 1994, provides guidance related to the installation of temporary remote thermal detectors (RTDs) readers to provide local monitoring of RHR heat exchanger inlet and outlet temperature. Based on the results of this walkdown, the team determined that actions necessary to provide temporary RPV level indication via the installation of a digital multimeter at terminal box for shutdown range level transmitter LT-B21-2N027 appeared feasible. However, due to several factors, including the location of required actions (technicians stated they would need to straddle RHR piping that is approximately 20' off the floor, and work in a high radiation area) and the general lack of emergency lighting, actions necessary to provide temporary indication of RHR inlet and outlet temperatures were not deemed feasible. Additionally, it was noted that equipment (instrumentation) and tools necessary to perform either of the repair activities were not dedicated for use and maintained in a controlled manner.

c. Conclusions

As a result of a review and walkdown of ON-100-009, Rev. 4, the team concluded that the alternative shutdown capability could be operationally implemented within the time line specified in the current SSA.

With regard to the installation of temporary instrumentation, the team agreed with the licensee's position that sufficient instrumentation would remain available at the RSP and repair activities delineated in the procedures would not be required to accomplish post-fire safe shutdown conditions. However, since these activities are directed by post-fire shutdown procedures and plant operators have indicated a strong preference for their use, the team concluded that the operational enhancements recommended by operations should be considered. In addition, the team concluded that the appropriate design enhancement to facilitate the implementation of these long-term shutdown instrumentation repairs, such as the installation of auxiliary connection points for temporary instrumentation, should be appropriately incorporated into the plant design.

F6.2.3 Post-Fire Safe Shutdown Operator Training

a. Inspection Scope

The licensee agreed to a simulator demonstration of its safe shutdown procedures for an MCR fire scenario, using the "shift in training." Operators were only told that there was going to be a fire in the MCR, that it would require evacuation, and that after approximately 2 minutes they could smell electrical insulation burning. It was assumed that both units were operating at 100% power at the time of the fire. The simulated fire occurred in control room cabinet 1 C601, resulting in inoperable controls, false instrumentation indications, and spurious equipment operations.

b. Observations and Findings

The scope of the training program for operators at SESS was observed to be quite comprehensive. This was evidenced during the inspection by the simulator demonstration that was carried out by the "shift in training" for an MCR fire scenario devised by the inspection team. Although the scenario developed was not part of the licensee's normal training curriculum, the operators successfully implemented the safe shutdown of the plant within the SSA-specified time line.

c. Conclusions

Based on the results of the simulator demonstration, walkdown of the licensee's off-normal and emergency operating procedures for achieving cold shutdown conditions in the event of a fire in the MCR, and discussions with the licensed operator training staff, operator training and qualification on the Appendix R safe shutdown procedures was found to be acceptable.

F6.2.4 Post-Fire Safe Shutdown Implementation Staffing

a. Inspection Scope

The team reviewed the adequacy of the shift manning to determine if there was sufficient staffing to accomplish post-fire safe shutdown and appropriately man the plant fire brigade.

b. Observations and Findings

SESS is a dual unit facility with a common MCR. Table 6.2.2-1 of the SESS technical specifications requires one Shift Supervisor (SS), one Senior Reactor Operator (SRO), three Reactor Operators (ROs), three Non-Licensed Operators (NLOs), and one Shift Technical Advisor (STA). Administratively, the licensee's operating shift manning is controlled by NDAP-QA-0300, Rev. 6. This administrative procedure establishes the minimum shift manning levels and requires the shift complement to consist of one SS, two Unit Supervisors, one Assistant Unit Supervisor (AUS), one STA, four Plant Control Operators (PCOs), five Nuclear Plant Operators (NPOs), and two Auxiliary Systems Operators (ASOs). All positions other than NPO, CPO, and ASO are SRO qualified. The AUS is also the designated fire brigade leader for either unit. The remaining four positions on the fire brigade are staffed by two security force members and two auxiliary equipment operators. The licensee indicated that it is its practice to assign fire-brigade-qualified security force and operations members to the brigade that are not assigned other duties that would preclude their immediate response to a fire alarm.

c. Conclusion

The team concluded, on the basis of its document review and the adequacy of the simulator demonstration and formal walkdown of the alternate safe shutdown procedure with a crew of seven, that post-fire safe shutdown implementation staffing was acceptable.

F6.3 Fire Protection of Safe Shutdown Capability

F6.3.1 Electrical Raceway Fire Barrier Systems

F6.3.1.1 Thermo-Lag Raceway Fire Barriers

a. Inspection Scope

The team reviewed the status of the actions the licensee is taking to resolve the technical issues related to the fire resistive performance of its Thermo-Lag raceway fire barrier systems. Past and future Thermo-Lag design and installation specifications were reviewed.

b. Observations and Findings

Summary of Licensee's Actions to Resolve Thermo-Lag Fire Barrier Technical Issues

In 1991, the NRC identified that Thermo-Lag fire barrier material did not perform to the manufacturer's specifications. NRC Bulletin 92-01, "Failure of Thermo-Lag 330 Fire Barrier System to Maintain Cabling in Wide Cable Trays and Small Conduits Free from Fire Damage," requested licensees with Thermo-Lag barriers to consider these fire barriers to be degraded and take appropriate compensatory measures for areas in which they were installed.

In 1992, PP&L declared 15,000 linear feet of Thermo-Lag inoperable and established a 1-hour roving fire watch in the A and C diesels rooms, the control structure, and both reactor buildings. The roving fire watch is still in effect.

In 1993, PP&L determined that the SSES Thermo-Lag installations were not uniquely tested. At that time the licensee decided to use the Nuclear Energy Institute (NEI) testing program data for Thermo-Lag qualification and rating.

in 1994, PP&L conducted an initial analysis of Thermo-Lag issue resolution methods and reverified the as-built configurations using videos and still pictures (the SSES "Phase 1 Walkdown").

In September 1994, Vectra (now Duke Engineering) was given a PP&L contract to conduct a "Fire Barrier Qualification Assessment" to determine:

- whether any current SSES Thermo-Lag configurations were rated, and
- what upgrades would be needed to obtain fire rated configurations.

At the end of 1994 the Vectra concluded that:

- no Thermo-Lag was qualified as is, but that
- most configurations were amenable to upgrade.

In the fall of 1994 PP&L conducted a Thermo-Lag-driven "Safe Shutdown Assessment" to determine how much Thermo-Lag could be disestablished. The "Safe Shutdown Assessment" concluded that approximately 7,500 linear feet of Thermo-Lag could be removed or abandoned in place (with removal preferable due to seismic, combustibility, and ampacity-derating concerns).

In September of 1995 PP&L commenced chemical and density testing of in-plant Thermo-Lag.

From 1995 to 1997 PP&L conducted a safe shutdown analysis revision and associated circuits analysis revision which concluded that:

- 7,000 linear feet of Thermo-Lag could be removed or abandoned.

- 4,000 linear feet of Thermo-Lag (largely electrical conduit wrap) should be upgraded to achieve the required fire rating.

- 4,000 linear feet of Thermo-Lag should be eliminated through rerouting of electrical cables (the modification option for 125V dc power, ESW control circuits, and selected instrumentation)

In February 1997, PP&L commenced destructive examination of unneeded Thermo-Lag to determine how to upgrade the rating of the barriers.

In a May 2, 1997, meeting with the NRC, PP&L committed to complete all actions by the end of calendar year 1999, except for some actions to be completed during the Unit 1 outage in 2000. The current strategy calls for adding 1/4" to 3/4" of material to existing Thermo-Lag or eliminating the need for derated Thermo-Lag barriers (typically by either changing the systems and components required for the accomplishment of post-fire safe shutdown or using new manual local operator actions).

PP&L ampacity derating calculation EC-01 3-0830 has been used to develop plant-specific ampacity derating values and calculations for all power cable raceway fire barriers (in case of their abandonment in place).

Design and Installation of Original Thermo-Lag Material

PP&L Specification F1 000, Rev. 4, 1989, "Design and Installation of Electrical Raceway Fire Barriers," was reviewed. Specification Change Notice (SCN) 96 was attached. It stated that Specification F1 000 is now only to be used for restoration of barriers installed under the specification, and that new Thermo-Lag material will be installed under Specification F101 O, discussed below.

Specification F1 000 contained a general Thermo-Lag installation process, Thermal Science, Incorporated (TSI) "Notes and Details" (typical rated fire barrier configurations) and a set of SSES-specific typical configuration drawings. Specification F1 000 made no' connection to barrier-specific fire testing information.

Design Change Packages (DCPs) for groups of Thermo-Lag barriers referenced Specification F1 000, but did not contain barrier-by-barrier as-built installation information. When installers determined that any particular barrier deviated from Specification F1 000, a Plant Change Request (PCR) was generated. The PCR then received an engineering evaluation by a civil engineer and a fire protection engineer. No fire tests were conducted for deviating configurations.

Construction details for original Thermo-Lag installations at SSES are by exception to Specification F1 000 through PCRS, and approval of these exceptions was based on engineering judgement, not fire tests.

For each DCP a backup ampacity calculation was run in accordance with Engineering Calculation EC-01 3-0830. Also for each DCP, a backup seismic calculation was run under PP&L Specification C-1035. Installation-specific isometric drawings were prepared to support the seismic analyses.

Original PP&L Thermo-Lag was installed under a contract with Transco. Transco also had quality control (QC) responsibility. During the second week of the inspection the licensee (over a 4-day period) was not able to provide barrier-specific nor Transco contract-wide Thermo-Lag barrier installation lesson plans, installer training records, or QC records. However, block 2B of the Construction Work Orders (CWOs) for each DCP did contain completed PP&L signoffs for review of Transco QC records subsequent to the installation.

The PP&L QC review signoff furnished evidence that, at the time of installation, the licensee ensured that the purchased services and materials conformed to the procurement documents.

PP&L Existing Thermo-Lag Destructive Examination

Engineering Calculation EC-01 3-1051, "Phase II Destructive Examination Report," summarized the results of destructive visual, chemical, and density testing on a representative sample of unneeded SSES Thermo-Lag barriers. The report concluded that SSES Thermo-Lag construction details were consistent with typical industry installations. PP&L letter PLA-4484, dated July 29, 1996, stated that, based on NEI testing of 15 SSES Thermo-Lag samples from each of the four SSES construction vintages, SSES Thermo-Lag materials were representative of the Thermo-Lag samples which were tested by the NEI. Further, PLA4484 stated that weight and density testing of representative SSES Thermo-Lag showed an average density less than that assumed in PP&L weight effects calculations. PP&L also stated that it would use the NEI Thermo-Lag 330-1 Combustibility Guideline in its combustibility calculations.

SSES is currently in the process of documenting the past methods it used to construct its Thermo-Lag 330-1 fire barriers.

Design and Installation of Thermo-Lag Material Upgrades

PP&L Specification F101 O, "Fire Barriers (Upgrade to Thermo-Lag and Kaowool,)" has been issued for bid under the licensee's assumption that, since 85 percent of SSES Thermo-Lag is in the form of conduit wrap, the Thermo-Lag fire barrier system can be upgraded in many cases by the addition of either a relatively thin layer of Thermo-Lag or a thin layer of a new material being jointly developed and tested by PP&L and Transco.

Specification FI 010 required the (as yet to be determined) winning contractor to do QA/QC in accordance with 10 CFR Part 50, Appendix B. PP&L plans to provide the winning contractor with a Design Change Package and raceway drawings showing barrier locations. Using Specification F1 010, the winning contractor will develop isometric drawings of the conduit and raceway runs and typical detail drawings for features such as radial bends, straight runs, junction boxes, and penetration seal interfaces. The winning contractor will also be responsible for developing detailed as-built installation drawings and, based on test reports, doing calculations for fire rating, ampacity derating, combustibility, and seismic loading. Upon completion of the contractor work, PP&L plans to conduct an acceptance review.

Ampacity Derating

As stated in PP&L letter PLA-4089 dated February 3, 1994, PP&L has determined "maximum allowable derating percentages" for its raceways and conduits (ranging from 28.9 percent to 38.5 percent). This is the percentage difference between the maximum design current-carrying capacity of its power cables and the actual service current carried by the cables during plant operation.

PP&L in its letter PLA-4560, dated February 4, 1997, advised the NRC that, after completing its in-plant Thermo-Lag reviews (targeted at confirming that SSES Thermo-Lag configurations are consistent with Texas Utilities Electric Company tested configurations) and comparing the IEEE P848, Draft 16, ampacity test data (obtained from Florida Power Corporation and Tennessee Valley Authority (TVA) tests), it had decided to set the calculated ampacity derating values for 1 -hour and 3-hour power cables at 21 percent.

Further, as documented in its letter PLA-4560, PP&L believes the nonstandard Thermo-Lag configuration (common-enclosure power cable conduits) found at SSES are bounded by an 8 percent TVA testing-derived derating value and the >8 percent conservatism of the 21 percent value. Therefore, since these bounding values are less then the "maximum allowable derating percentages" above, the licensee has concluded that no reductions in the service currents of its power cables are needed.

Walkdown

The team performed a walkdown on the Thermo-Lag 330-1 installed in the lower cable spreading rooms (LCSRs). The licensee had performed some destructive testing on these Thermo-Lag 330-1 electrical raceway fire barriers to determine the methods of installation. The results were that SSES used both prefabricated panels (half rounds and flat board) and spray-on Thermo-Lag 330-1. The material could be approximated as a nominal 5/8" thickness. The existing installations appeared on the surface to provide a reasonable baseline for upgrades. Review of SSES Drawing Change Mechanism PCR No. 88-3016 (Control No. 89-5406) indicated a design deficiency in the Thermo-Lag 330-1 cable tray installations. The PCR changes a drawing note on Drawing No. EIP-0871 to read: "If Thermo-Lag board is used remove stress skin first." The disposition states: "While it is true that the stress skin adds strength to the T-L Board, T-L retains its rating (1 or 3 Hr.) regardless of the presence of the stress skin. Board thickness is the critical factor. Removing the 'skin' ensures that the minimum thickness is present."

The team finds that the licensee's disposition related to the removal of stress skin from Thermo-Lag panels is not technically sound. Industry testing has demonstrated that stress skin is a necessary element in providing structural integrity for the prefabricated Thermo-Lag panel during a fire exposure.

c. <u>Conclusion</u>

The team concluded that PP&L is working towards resolution of the Thermo-Lag issues at SSES. PP&L has committed to the staff to complete all Thermo-Lag resolution actions (that is, return SSES to compliance with existing NRC requirements) by the year 2000. However, the team noted that degradation resolution strategies for specific Thermo-Lag barriers, and Design Change Packages for barrier upgrade modifications for specific Thermo-Lag barriers, had not been developed by PP&L at the time of the inspection, and therefore modification schedules had not been developed as well.

F6.3. I.2 Kaowool Raceway Fire Barrier Systems

a. Inspection Scope

SESS originally used both Kaowool and Thermo-Lag 330-1 fire barriers to protect essential raceways needed for PFSSD. In response to the concerns raised by the NRC about Thermo-Lag 330-1 in GL 92-08 and subsequently about Kaowool in INs 93-40 and 93-41, the licensee expanded its Thermo-Lag review to include the Kaowool barriers. The team reviewed the actions the licensee was taking to replace the Kaowool barriers with a qualified 1-hour fire rated barrier.

b. Observations and Findings

Kaowool was installed on approximately 2,000 linear feet of conduit, 40 linear feet of wireway, and 110 feet of cable tray at SSES. The licensee has inspected approximately 360 feet of conduit and 22 feet of cable tray. Based on this inspection and INs 93-40 and 93-41, the licensee determined the SSES installations had a number of deficiencies and the barriers were not installed in accordance with the tested configuration. The licensee decided to include the Kaowool barriers within the scope of its Thermo-Lag improvement program and resolve both issues together. The licensee has committed to remove the required Kaowool barriers and to replace them with a qualified 1-hour rated barriers.

c. Conclusion

The team concluded that the licensee's actions to resolve the Kaowool barrier fire-resistive and ampacity technical issues are a step towards improving the level of fire safety at the facility. In addition, the team views the licensee's actions as demonstrating the licensee's understanding of the technical and fire-resistive weaknesses associated with Kaowool fire barriers.

F6.4 Design Base Verification of Fire Protection Systems and Features

Fixed fire suppression and detection systems are used at SSES to protect safe shutdown paths (1 O CFR Part 50, Appendix R III.G. compliance). Automatic actuation of the suppression systems is typically accomplished by a single interlock (i.e., a single smoke or heat detector will actuate the suppression system). The fixed suppression system is typically the primary fire protection for an area, with the standpipe and hose stations serving as backup. The following sections of this report contain the team's observations and findings from its audit of each type of system.

F6.4.1 Fire Detection and Alarm Systems

a. Inspection Scope

SER, Section 9.5.1.4, "Fire Detection Systems,"identified NFPA 72D, "Standard for the Installation," Maintenance and use of Proprieta~ Protective Signaling Systems for

Watchmen, Fire Alarm and Supervisory Service," as the design basis document. The code of record is the 1975 edition. The associated standard for detector placement is NFPA 72E, "Standard on Automatic Fire Detectors." The code of record for NFPA 72E is the 1974 edition. There are no documented exceptions to either code for the installed systems. Furthermore, approved Appendix R deviations state that one of the technical justifications for approving the deviation is the area-wide detection system installed in accordance with NFPA 72 and its ability to detect an incipient fire,.

The scope of this inspection was to walk down and review detection systems installed in the general area spaces of the Unit 1 and 2 reactor buildings.

b. Observations and Findinas

The team performed a walkdown of the fire and smoke detection systems on elevations 670'-0"of the Unit 2 reactor building, and 719'-0" and 749'-0" of the Unit 2 reactor building. Listed below are findings based on that walkdown.

Elevation 670'-0"

Detector 1-1-222 is suspended more than 2 feet below the ceiling, hanging freely. This configuration does not appear to meet NFPA 72E (1975), Section 4-3.1.

Detector 1-1-219 is also suspended more than a foot below the ceiling. This does not appear to meet NFPA 72E (1975), Section 4-3.1.

The thermal detectors (1 of 2 logic) are needed to actuate the water spray system protecting the HPCI. These detectors are mounted off to the side along structural steel members. One detector appears to be located in a dead air pocket too close to the structural steel. This appears not to meet NFPA 72E (1975), Section 3-4.1.

Elevation 719'-0"

Board room 407 has only two detectors located in beam pockets. One of the smoke detectors (2-I-36) is mounted less than 1 foot from the HVAC fresh air supply diffuser. Fresh air from this diffuser is directed directly across the detector, thus making the detector inoperable with respect to detecting a fire in its incipient stage. This configuration conflicts with the criteria of NFPA 72E (1975),

Section 4-5.1.5, "Air Conditioned Facilities." Board room 406 has the same issues as room 407.

The ceiling height on elevation719' is approximately 30'. Ceiling heights over 12' to 15' are typically considered high. NFPA 72E (1975), Section 4-4.1, "General Spacing Requirements," requires that sound engineering judgment be applied to detector spacing for nonstandard configurations. The design engineer shall consider such variables as ceiling shape and surface, ceiling height, configuration, contents, burning characteristics of contents, and the effects of ventilation systems. NFPA 72E (1975), Section 4-4.5, "High Ceilings," requires detectors be installed on alternate levels. Walkdowns and field measurements indicate that the spot detectors were installed on approximate 30' centers. There are no alternate levels of detection, and reduction in detector spacing is not apparent. NFPA 72E, Section 4-4.6, also provides requirements for spacing in beam construction. Beams that are 18" deep and greater than 8' on center require at least one detector in each bay. Although the beam spacing is typically less than 8' on center, many of the beams are much greater than 18" in depth, which complicates the design, forming many small beam pockets. This would further inhibit smoke travel across the ceiling. Reasonable engineering judgment would suggest that additional spot detectors and reduced spacing are necessary to provide reasonable assurance that a fire is detected in its incipient stages.

Elevation 749'-0"

The ceiling height and beam construction on elevation 749'-0" is basically the same as on elevation 719'-0", and the weaknesses noted with regard to detection placement and spacing are also the same.

The equipment access area hall overhead is obstructed by an HVAC duct. This duct forms a false ceiling. Adequate obstruction sprinklers are installed. However, the sprinkler system is a preaction system requiring automatic detection to operate. There are no detectors mounted below the obstruction. In the event of a fire under this obstruction, it is questionable if the preaction sprinkler system could quickly control the fire without additional detectors under the obstruction.

The team reviewed PP&L Calculation EC-013-0920, Rev. O, "Evaluation of Fire Detection System per NFPA 72 E." The team noted technical concerns related to the adequacy of the licensee evaluation and its ability provide the reasonable assurance needed to support the defense-in-depth fire protection principle that plant fires will be promptly detected.

Item 5.6 of Section 5.0, "Method," states: "The actual coverage area per detector was calculated by dividing the fire zone area by the number of detectors." This method of averaging the area of coverage does not meet the criteria of NFPA 72E. NFPA 72E (1974), Section 4-4, "Spacing," and Section 4-5, "Special Considerations," explain in detail the criteria for locating individual spot detectors. Additional examples are provided in the appendix of NFPA 72E. Deficiencies in the system design (such as the ones described in board room 407 above) are overlooked and hidden by this method. For all practical purposes room 407 only has one operable detector. This method is also in direct conflict with the code requirements for items such as spacing from walls.

The licensee's evaluation and method ignored high ceilings. NFPA 72E, Section 44.5, specifies that additional spot detectors are needed for this design situation.

In addition, this evaluation and method did not consider the extensive network of beam pockets formed in the structure of the ceilings. Structural steel drawings E-105315 (Rev. 15), and" E-105316 (Rev. 14) depict these beam pockets. From an engineering prospective, it is easy to see how these beam pockets will channel and divert the dynamic fluid flow of the smoke after it has risen (being buoyant) and begins to spread out across the ceiling.

Appropriately, high ceilings, deep beam pockets, and detector spacing limitations should be considered simultaneously in establishing the limiting parameters of the system design. Evaluating one parameter without considering the others will give a false impression of the design. Additionally, the calculation identifies clear deficiencies in the design (Section 6.1), which are then ignored. Section 6.2 of the calculation states: "It is concluded that the SSES fire detection system meets the intent of the guidelines as prescribed by NFPA 72 E." From its review of the licensee's detection design evaluation and calculation, the team could not conclude that the detector spacing met NFPA 72-E. In addition, the team found that the evaluation and calculation, because of analytical weaknesses, did not support the defense-in-depth principle that fires be rapidly detected.

c. <u>Conclusion</u>

The team identified issues associated with the installed fire detection system and its ability to meet the installation criteria established by the applicable NFPA COR.

SSES Operating License NPF-14 (Unit 1) Condition 2.C (6) and NPF-22 (Unit 2) Condition 2.C(3) specify that the licensee implement and maintain in effect all provisions of the approved fire protection program as described in the FPRR for the facilities and as approved by the NRC SER dated August 9, 1989. The NRC based its approval of the SSES fire protection program on the licensee's commitment to follow the guidance of Appendix A to BTP APCSB 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants," and the licensee's commitment to meet Sections III.G, 111. J., and III.L of Appendix R to 10 CFR Part 50.

SER, Section 9.5.1.4, "Fire Detection Systems," identified NFPA 72D, "Standard for the Installation, Maintenance and Use of Proprietary Protective Signaling Systems for Watchmen, Fire Alarm and Supervisory Service," as the design basis document.

Contrary to the above, as of November 7, 1997, the licensee could not adequately demonstrate that the fire detection system in the areas inspected met minimum industry fire protection codes. Specifically, the licensee could not demonstrate that the design considered all environmental and physical aspects of the installation including, but not limited to high ceilings, effects of the ventilation system on smoke movement, obstructions, and beam pocket ceiling "construction. This is identified as an unresolved item, Fire mitigation system design and installation does not appear to meet minimum industry codes and standards. (Unresolved item, 50-387, 388/97-201 -05)

F6.4.2 Water Supplies

a. Inspection Scope

SER Section 9.5.1.1, identified NFPA 20, "Standard for the Installation of Centrifugal Fire Pumps," as the design basis document. The COR is the 1974 edition. Along with NFPA 20, the ancillary codes required for the installation are NFPA 22, "Standard for Water Tanks for Private Fire Protection" (COR 1974 edition), and NFPA 24, "Standard for Outside Protection," (COR, 1973 edition). There are no licensee-documented deviations from the CORS for the fire protection water delivery system. These CORS were used to review certain design and installation attributes associated with the installed fire protection water supply and distribution system.

b. Observations and Findings

The SER describes the system thus: "The pumps take suction from the two clarified water storage tanks of which 300,000 gallons are reserved for fire protection in each tank. A second water source is provided by the six million gallon cooling tower basin." This is incorrect. There is only one 500,000 gallon clarified water tank.

The team conducted a waikdown of the pump installation. The fire pump installation was found to be in good material condition. Review of the flushing program indicated that there currently was no trending program to monitor the internal condition of the carbon steel portions of the piping system (i.e., monitor the lower Hazen-Williams "C" Factor and reduced internal pipe diameter as the system ages). Based on industry operating experience, the use of clarified water from the tank intermittently mixed with raw water from the cooling tower basin warrants the establishment of a trending program.

c. Conclusion

The overall fire protection water supply delivery system appeared to be in good order. Within the areas inspected the team did not identify any code discrepancies.

F6.4.3 Fixed/Automatic Fire Suppression

a. Inspection Scope

SER' Section 9.5.1.2, "Sprinkler and Standpipe Systems," identified NFPA 13, "Standard for the Installation of Sprinkler Systems," as the design basis document. The NRC has previously provided guidance on sprinkler system installations. in GL 86-10, Question 3.4.5, "Sprinkler Head Location," the staff provided the following guidance: "Sprinkler heads should be located at the ceiling. Sprinkler heads at other locations maybe necessary depending upon the hazard and the cumulative effect of the obstructions to the discharge of water from the sprinkler head. The sprinkler system design should meet NFPA 13." In addition, in Question 3.8.1, the NRC staff provided its position regarding "Fire Protection Features-NFPA Conformance," and compliance with the criteria specified in the NFPA codes and standards.

The sprinkler system design COR is the 1974 edition and the licensee has not documented any deviations-from the code for the installed systems.

This NFPA standard was used to review certain design aspects of the sprinkler systems installed in the general area spaces of the Unit 1 and 2 reactor buildings.

b. Observations and Findinas

Appendix R deviations state that one of the technical justifications for the deviation was the area-wide sprinkler system installed in accordance with NFPA 13. Therefore, the team performed a walkdown of sprinkler systems installed on elevation 670'-0" of the Unit 1 reactor building and elevations719'-0" and 749'-0" of the Unit 2 reactor building. The following observations and findings were made as a result of this walkdown.

Elevation 670'-0"

The upright sprinkler head, on a nipple riser, located outside door 1-109 (remote shutdown panel) is configured incorrectly with the sprinkler head and its deflector at a 45° angle. The sprinkler also has what appears to be spray-on Thermo-Lag 330-1 on the fusible link and deflector. These conditions do not appear to meet NFPA 13(1974), Sections 3-15.2.1, 3-15.9, and 4-2.4.7.

An upright sprinkler head located at the HPCI pumps is connected to a %" X 4" pipe nipple and is obstructed. This presents two problems. First, the sprinkler head is located in a pocket formed by structural steel and the spray patter from the head is obstructed on all sides. The adjacent sprinkler heads are not spaced appropriately to compensate for this condition. This condition does not appear to meet NFPA 13 (1974), Section 4-2.4.6. Second, the use of pipe smaller than 1" is prohibited by NFPA 13 (1974), Section 7-1.1.2 for use of the flow restriction.

Elevation 719'-0"

Outside the traveling incore probe (TIP) room (door 406), there are obstructions below the sprinkler heads (e.g., light fixtures, beams, electrical junction boxes). This does not appear to met the guidance of NFPA 13 (1974),
Chapter 4.

Face bushings are installed in the system. (Example: reduced tee outside the TIP room.) The use of these bushings does not meet NFPA 13 (1974), Section 3-12.3.

The control rod drive (CRD) area has multiple overhead obstructions (e.g., lighting fixtures, beams, electrical components) that, when the total obstructed area is considered, inhibit the sprinkler from developing and delivering an effective spray pattern to the floor within the protected area. The combined area of these obstructions exceeds the industry code requirements of NFPA 13 (1974), Section 4+,13 (also see NFPA 13, Appendices A-4-4.13 and B-4-2.3, and NRC guidance provided in GL 86-10 Question 3.4.5). Other areas where the sprinklers are obstructed include both sides of the Unit 2 HVAC Zone 2 duct and the area near column line Q36 where the HVAC duct and cable tray form obstructions.

Elevation 749'-0"

In the area near column line T30.5 there is a concentration of stored radiation worker C-zone clothing. There is also Thermo-Lag installed in the area. The ceiling level sprinklers are obstructed by an HVAC duct which is greater than 4'-0" in width. This obstruction exceeds the NFPA 13 (1974) and NRC GL 86-10 criteria and would impede water spray from the overhead sprinklers to a floor-based fire.

Thermo-Lag barrier E2KK21 located in the overhead above the chillers forms a combustible obstruction to the sprinklers which is greater than 4'-0". There are no sprinklers located below the barrier.

c. COnclusion

The team identified plant conditions that affected the ability of the sprinkler system to react to a fire and might adversely affect system performance. The team concluded that certain sprinklers systems installed at SSES exhibited weaknesses in meeting the COR, specifically with regard to the placement of sprinkler heads, area of sprinkler head coverage, and obstructions to the area of coverage.

Additionally, the licensee could not provide the team with an evaluation which addressed the code deviations the team identified during its walkdown inspection. Therefore, the sprinkler system deviating conditions are identified as another example of the program weakness related to plant fire protection features that do not meet the minimum industry codes and standards.

SSES Operating License NPF-14 (Unit 1) Condition 2.C (6) and NPF-22 (Unit 2) Condition 2.C(3) specify that the licensee implement and maintain in effect all provisions of the approved fire protection program as described in the FPRR for the facilities and as approved by the NRC SER dated August 9, 1989. The NRC based its approval of the SSES fire protection program on the licensee's commitment to follow the guidance of Appendix A to BTP APCSB 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants," and the licensee's commitment to meet Sections III.G, 111. J., and III.L of Appendix R to 10 CFR Part 50.

SER Section 9.5.1.2, 'Sprinkler and Standpipe Systems," identified NFPA 13, 'Standard for the Installation of Sprinkler Systems," as the design basis document. The sprinkler system design COR is the 1974 edition and the licensee has not documented any deviations from the code for the installed systems.

Contrary to the above, as of November 7, 1997, the licensee could not adequately demonstrate that the sprinkler systems in the areas inspected met minimum industry fire protection codes. Specifically, the licensee could not demonstrate that the design met the COR with regard to the placement of sprinkler heads, area of sprinkler head coverage, and obstructions to the area of coverage. This is identified as an unresolved item; Fire mitigation system design and installation does not appear to meet minimum industry codes and standards. (Unresolved Item, 50-387,388/97-201-05)

F6.4.4 Total Flooding Gas Suppression System

a. Inspection Scope

SER Section 9.5.1.3, 'Gas Fire Suppression Systems," identifies NFPA 12, "Standard on Carbon Dioxide Extinguishing Systems,"and NFPA 12A, "Standard on Halogenated Fire Extinguishing Agent Systems-Halon 1301 ," as the design basis document. NFPA 12 and 12A (1 973 editions) are the CORS and the licensee has not documented any deviations from these CORS.

These industry fire protection codes were used to review certain aspects of the gaseous fire suppression system designs installed in the north, center, and south cable chases, Unit 1 lower relay room, Unit 2 lower relay room, Unit 1 upper relay room, and Unit 2 upper relay room.

b. Observations and Findings

The power generation control complex (PGCC) is protected by a Halon 1301 fire suppression system. The system was designed and installed by General Electric (GE) as a part of a packaged system. The system protects the panels, termination cabinets, and the under-floor area. The design concentration is 20 percent by volume with a 20-minute soak time. The system is also designed to achieve 6 percent by volume in 10 seconds in the panels. Smoke detectors are provided for early alarm, with thermal detectors petiorming the system discharge. The licensee maintains the prepackaged system under Installation and Operation Manual (IOM) 444. The team field verified the system configuration and found no apparent modifications to the original GE package. Based on this field review, no further review of the system or its design basis was performed.

Inadequate testing of gaseous fire suppression systems has been an industry concern. The latest information 'on this matter is provided in IN 92-28, "Inadequate Fire Suppression System Testing."

At SSES, automatic, total flooding, low pressure CO_2 systems are installed in the north, center, and south cable chases, Unit 1 lower relay room, Unit 2 lower relay room, Unit 1 upper relay room, and Unit 2 upper relay room. In addition, manual, total flooding, low pressure CO_2 systems are installed in the north, center, and south cable chases control room level, Unit 1 and 2 control room under floor, Unit 1 and 2 control room soffit, and rooms C-411, 412, 413, 414 soffit.

These systems were designed and supplied by Cardox under Bechtel Specification 8856-M-344. Section 10.3 of the specification states: "A full carbon dioxide discharge and concentration test shall be made for each hazard." The first CO_2 system to have its full discharge concentration test (in accordance with NFPA12(1973), Section 134) during the pre-operational test program was the elevation 698' north cable chase. PP&L personal explained that during the full discharge test, an approximately 32" x 32" door either blew open or was left open, forcing the test to be terminated. The failure to maintain the door in the closed position was attributed to the instrument leads that passed through the door opening.

In an effort to understand the licensee's basis for not performing the full discharge tests specified in NFPA 12, the original specification, and the pre-operational test program, the team reviewed a number of PP&L historical documents. The key documentation is summarized below. A Test Change Notice (TCN) was written against the original procedure. TCN 1 for procedure P 13.2 states: "Reason for TCN: CO_2 concentration tests have been scheduled after pre-operational test has been completed." The change required was to "delete step 4.1.8 from the test prerequisite list." Step 4.1.8 of procedure P 13.2 states: "The subcontractor has successfully completed all inspections and tests required by Section 10 of Technical Specification M344, Revision 4. (These tests include determination of time required to reach 30 percent carbon dioxide concentration and system ability to achieve 50 percent carbon dioxide concentration in each hazard area.) Appropriate test reports, inspection records and forms are on file. " This step directly supports Test Objective 5: "The ability of the Carbon Dioxide Fire Protection system to establish proper CO_2 concentrations in each hazard area." The cover of TCN 1 also contains the reference: "See Work Authorization (WA) U27611 for the Satisfactory Results and Test Data Recorded During Concentration Test Performed on 4/20/82." Review of WA U27611 indicated that a test was performed on north cable chase elevation 698'. The report indicated 150 seconds of discharge, temperature drops from 750 F to 24 'F, and pressure changes from 0.40" to 4.0" water column (w.c.), then a rapid depressurization to O. 10" w.c. There was no information recorded in the CO_2 Concentration % column. The strip recorder charts were attached to the WA. Review of the chart indicates that probes were placed at 1', 7', and 14' from the floor. All three probes indicated a 30 percent concentration at less than 2 minutes. The probe at 1' held 50 percent concentration for approximately 13 minutes, the probe at 7' held 50 percent concentration for approximately 12 minutes, and the probe at 14' held 50 percent concentration for approximately 5 minutes. Based on this information, the system did not meet acceptance criteria. A typical total flooding CO_2 system protecting a deep-seated fire hazard is designed to hold the 50 percent concentration for 20 minutes. Based on the Sandia National Laboratories testing reported in NUREG/CR-3656, PP&L has reduced its acceptance hold time (at a minimum 50 percent concentration) to 15 minutes. None of the probes demonstrated acceptable hold times. The tests were to be witnessed by Factory Mutual (FM); however, the document was not signed by FM as being an acceptable test. The WA does not provide additional information on the failure of the test. In a Mutual Atomic Energy Reinsurance Pool (MAERP) reinspection report dated April 23, 1982 (Index 38841 .60), the inspector acknowledged the failed test but wrote: "[it] was decided that the required- 50 percent concentration would have been maintained throughout the vertical cable chase had the access door not been left open and therefore the installation is being considered acceptable." The MAERP inspector concluded: "In the future 'tiring testing, carbon dioxide concentration levels will be monitored for a minimum of twenty minutes to permit a more complete evaluation of how well the extinguishing agent is holding." The future CO_2 tests were never performed.

In a letter dated June 2, 1989, NRC Region I documented the results of combined Inspection Reports Nos. 50-387/89-09 and 50-388/89-09. The report states: 'During the course of this inspection, questions were raised regarding the adequacy of the initial acceptance testing of a number of the CO_2 fire suppression system." The results of the inspection is the following: "The inspector identified a concern regarding the adequacy of the carbon dioxide systems. The adequacy of these systems was questioned because it could not be demonstrated that adequate initial acceptance tests for these systems had been performed." The detail section of the report provides this additional information: "The licensee in the Final Safety Analysis Report (FSAR) committed to perform tests of the CO_2 systems to demonstrate proper operation of the system.. ." A followup telephone call on April 18, 1989, between the inspector and the licensee determined that a full discharge initial acceptance test was performed in the north cable chase. Initial acceptance tests for the other areas were not performed. The licensee, during the April 18, 1989, telephone call indicated that the decision was made during the pre-operational phase not to test the other systems because of concerns that CO_2 cooling could adversely affect sensitive electrical equipment. The licensee stated that since the north cable chase CO_2 system passed the acceptance test, additional testing of the other CO_2 systems was unnecessary. It was the licensee's view that "the other systems will perform as well as the tested area." The NRC identified this as an unresolved item (50-387/89-09-01 and 50-388/89-09-01).

In a SER dated May 12, 1992, the NRC documented its review of the licensee's proposed alternative to full discharge testing of the CO_2 systems. The NRC concluded that the licensee's actions were adequate to provide reasonable assurance that the installed CO_2 fire suppression systems would function as designed and that the unresolved item from Inspection Report 89-09-01 had been adequately addressed. Specifically, the SER concluded:

> The staff found that the licensee has taken appropriate measures to demonstrate that, with the exception of those automatic systems protecting the north, center and south cable chase enclosures, the total flooding CO_2 fire suppression system listed in the SSES TSS will perform satisfactorily in service. The licensee has committed to increase the amount of CO_2 injected to each cable chase enclosure. The minimum amount of CO_2 required will be that amount for which a computer model reviewed by the staff predicts a 50% CO_2 concentration will be maintained for 15 minutes. Based on this action, the staff also concluded that the licensee has committed to take the appropriate measures to demonstrate the automatic total flooding CO_2 fire suppression system protecting the north, center, and south cable chase enclosures will perform satisfactorily in service. Due to the uncertainty of certain input

parameters and the ability to compare the model response to limited data from the full discharge test performed for the north cable chase, the staff only considers this computer model appropriate for use in evaluating the response of cable chase enclosures at SSES to a CO_2 discharge.

The initial full discharge test as documented in WA U27611 failed the test acceptance criteria of NFPA 12 and the system design specification (Bechtel .8856-M-344) (i.e., for deep seated fires, a 50 percent CO_2 concentration for a minimum of 20 minutes). The CO_2 concentration hold time was not acceptable. The increases in pressure should have been acceptable (and therefore contained) for a light building as defined by NFPA 12 (1973), Section 2623. Therefore, due to the above-listed test deficiencies, referencing this test for acceptance is not technically sound. In addition, during a phone conversation with the NRC, as documented in the NRC letter dated June 2, 1989, the licensee stated that since the north cable chase CO_2 system passed the acceptance test, additional testing of the other CO_2 systems was not necessary. Since the basis of the NRC's acceptance is not accurate because of inconclusive test results, the data extrapolation made by the licensee provided limited insights regarding system performance and does not form an adequate technical basis for judging how other CO_2 system installations would perform. No pre-operational test discrepancy report was initiated to document the north cable chase CO_2 system failure. The procedure was then revised to eliminate the full discharge test. This is inconsistent with CO_2 testing and does not meet the objectives of the specification and the test plan, bringing the entire CO_2 pre-operational test into question.

The use of a "door fan test" is considered an acceptable method of verifying the tightness of an enclosure, which is one element of a properly designed, installed, and functioning gaseous suppression system. It is appropriate to use this method for a CO_2 system as a verification test after a system has successfully completed the required initial acceptance tests. However, this test in and of itself does not provide reasonable assurance that the system will perform as designed. For example, the door fan test does not establish the ability of the piping system to deliver the extinguishing agent at the required rate of discharge. This is especially true with two-phase flow media such as CO_2. It is common during startup and pre-operational system testing to discover design discrepancies in a newly installed CO_2 system such as icing and clogging of nozzles, obstructions impacting nozzle discharge, or excessive pipe movement during discharge. The full discharge test also confirms that the calculated values (pipe size and configurations, number of nozzles, nozzle orifices sizing, and timer settings, etc.) are adequate. Likewise, the full discharge test confirms damper closure and helps identify design weaknesses, if any, such as the failure of ducts due to a sudden inrush of pressure and rapid cooling. The door fan test method is not capable of detecting deficiencies in CO_2 system design and performance.

During the April 18, 1989 phone call, the licensee indicated 'that the decision was made during the pre-operational phase not to test the other systems because of concerns that CO_2 cooling could adversely affect sensitive electrical equipment." BTP Chemical Engineering Branch (CMEB) 9.5.1, Section C.5, "Carbon Dioxide Suppression Systems," specifies that consideration also be given to the "possibility of secondary thermal shock (cooling) damage." Further, Appendix A to 10 CFR Part 50, GDC 3, states: 'Fire fighting systems shall be designed to assure that-their rupture or inadvertent operation does not significantly impair the safety capability of those structures, systems, and components." Based on this statement and the licensee's concerns regarding future full discharge testing, the team is concerned that CO_2 may not be an appropriate extinguishing agent for the various electrical rooms.

c. Conclusion

From its review of CO_2 suppression systems installed at SSES, the team concluded that these systems, because of the lack of appropriate pre-operational system discharge testing, may not be capable of performing their intended fire control functions. In addition, the team concluded that the application of these systems may not meet the intent of GDC 3 due to the licensee's concerns related to thermal shock to electrical equipment. Therefore, this is identified as an unresolved item, The operational suppression capability of the CO_2 systems has not been demonstrated by full discharge tests. (Unresolved Item 50-387,388/97-201 -06)

F6.4.5 Hose Stations and Standpipes

a. Inspection Scope

SER Section 9.5.1.2, "Sprinkler and Standpipe Systems," identified NFPA 14, "Standpipe and Hose Systems for Sizing, Spacing, and Pipe Support Requirements," as the design basis document. The COR is the 1974 edition. The licensee has not documented any deviations from the code for the standpipe and hose station system installed at SSES. The team used this fire protection code to review certain design aspects of the standpipe and hose station system installed in the general area spaces of the control and reactor buildings.

b. Observations and Findings

The team walked down the standpipe hose stations in the control building. SSES uses a Class II system as defined by NFPA 14 (1974). NFPA 14 defines a Class II system as one that is to be "primarily used by the building occupants until the arrival of the fire department (small hose)." NFPA 14 (1974), Section 332, further states: "The number of hose stations for Class II service in each building and each section of a building divided by fire walls shall be such that all portions of each story of the building are within 30 feet of a nozzle when attached to not more than 100 feet of hose."

The team examined hose stations 1 HR 158 and 1 HR 125. These hose stations provide manual water fire suppression to the MCR and the Unit 1 lower cable spreading room, respectively. These hose stations were found in good working order. They were equipped with an electric safe nozzle and pressure reducing disk. Gaskets were installed at the valves and nozzle connections. The team measured from each hose station into the respective area and determined that the hose station coverage (i.e., 100' of hose plus 30' hose stream) was adequate.

During the week of October 27, 1997, licensee personnel walked down additional hose stations and discovered standpipe hose stations that did not meet their licensing and design basis and, therefore, could not provide the required area of coverage with the allotted 100' of fire hose. The licensee documented this issue in CR 97-3650.

c. Conclusion

The team concluded that, focusing on the hose station layout, including inspection, the licensee took the initiative to perform additional reviews of the standpipe system and as a result of these reviews found areas outside of the required coverage and issued CR 97-3650.

SSES Operating License NPF-14 (Unit 1) Condition 2.C (6) and NPF-22 (Unit 2) Condition 2.C(3) specify that the licensee implement and maintain in effect all provisions of the approved fire protection program as described in the FPRR for the facilities and as approved by the NRC SER dated August 9, 1989. The NRC based its approval of the SSES fire protection program on the licensee's commitment to follow the guidance of Appendix A to BTP APCSB 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants," and the licensee's commitment to meet Sections III.G, 111. J., and III.L of Appendix R to 10 CFR Part 50.

SER Section 9.5.1.2, 'Sprinkler and Standpipe Systems," identified NFPA 14. "Standpipe and t-lose Systems for Sizing, Spacing, and Pipe Support Requirements," as the design basis document. The COR is the 1974 edition. The licensee has not documented any deviations from the code for the installed standpipe and hose station system.

Contrary to the above, as of November 7, 1997, the licensee could not demonstrate that standpipe hose stations met their licensing and design basis by providing the required area of coverage to all structures, systems, and components important to safety with the allotted 100' of fire hose. This is identified as an unresolved item, The design and installation of standpipe and hose systems do not appear to meet the criteria of NFPA 14-1974. (Unresolved Item, 50-387,388/97-201-05)

F6.4.6 Passive Fire Protection Features

a. inspection Scope

The licensee recently installed new carpet in the MCR. The flammability testing of this carpeting was evaluated by the team against NRC and industry fire protection guidance to determine its acceptability for use.

b. Observations and Findings

Recently, the MCR had been renovated and new carpet installed. The SESS licensing basis (Appendix A to BTP APCSB 9.5-1, Section D. 1.(d)) requires that interior finishes be classified as having a flame spread, smoke and fuel contribution of 25 or less in their use configurations when tested in accordance with American Society of Testing Materials (ASTM) E-84. Since the issuance of the BTP, the fire protection industry has made numerous advances in interior finish and carpet flammability testing. Underwriters Laboratories, Inc. (UL), now has specific tests for floor coverings instead of the general ASTM E-84 flame spread test. The vast majority of carpet manufacturers now using these new tests. The licensee recognized this change and issued its position on the new flammability testing criteria in a "Memo to File, File A20-1 SO I3AI7-15." The licensee acknowledged these new test methods and adjusted their flammability testing requirements accordingly. PP&L Service Order No. 6-49937-5 provides the flammability requirements consistent with this position. The carpet installed was tested in accordance with ASTM E-648, "Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source"; NFPA 253, "Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source"; Federal Test Method DOC-FF-1-70, "Standard for the Surface Flammability of Carpets and Rugs." The carpet met the Class I interior floor finish criteria as defined in NFPA 101, "Life Safety Code." Class I interior floor finishes are materials that exceed the test requirements when exposed to a minimum critical radiant flux of 0.45 watts/cm^{2}. This classification is specified by NFPA 101 in areas such as health care facilities where nonambulatory occupants are not capable of rapid exit and require a higher level of protection.

c. Conclusion

The team concluded that, in procuring the new carpeting, the licensee specified that the carpeting meet the Class I flammability testing acceptance criterion when tested in accordance with ASTM E-648. In addition, the team confirmed that the carpeting installed had been certified by the manufacturer to meet this specified criterion. Therefore, the team concluded that the new MCR carpeting meets the most stringent criteria established by current interior floor finish classification testing standards.

F6.5 Emergency Lighting and Communications

F6.5. 1 Emergency Lighting

a. Inspection Scope

The team observed the condition and aiming of emergency lighting units (ELUS) during tours of the facility and a walkthrough of ON-100-009, Rev. 4, "Control Room Evacuation."

b. Observations and Findings

Section III.J of Appendix R to 10 CFR Part 50 specifies that fixed, self-contained lighting with individual 8-hour minimum battery power supplies be provided in areas that must be manned for safe shutdown and for access and egress routes to and from those areas. During a tour of the E diesel generator building, an inspector found six nonfunctional ELUs. When this was brought to the attention of the licensee, the initial response was that there were no safe shutdown ELUS in the E diesel building. The inspector questioned whether that was true when the E diesel generator-was connected in place of one of the divisional diesel generators. Additional review by the licensee determined that although the six failed ELUS were not safe shutdown units, there are nine safe shutdown ELUS in the E diesel generator building. Condition Report 97-3501 was generated to document that these units were not correctly identified and were not receiving appropriate testing and maintenance.

During a walkdown of the licensee's safe shutdown procedure ON-100-009, the adequacy of emergency lighting provided for areas where manual operator actions were required was evaluated on a sample basis. In addition, the emergency lighting provided for access to and egress from these manual operator action areas was sampled. The RWCU equipment, which is required by the post-fire safe shutdown procedure to be checked for leakage, is located in a corridor on the 779' elevation of the reactor building, on the west side, and is not provided with fixed, self-contained 8-hour battery pack ELUs. In addition, step 4.4.3 requires opening breaker1Y219-018 to stop RWCU leakage or diverting reactor water to radwaste or the condenser via RWCU. Power panel 1Y219, located on 719' elevation of Unit 1 reactor building, is also not illuminated by an ELU.

For a fire requiring shutdown from outside the MCR, flow control valve HV-243-F023A must be closed to ensure that shutdown cooling (SDC) return water to the vessel injects into the core region and not into the recirculation loop. Since this valve cannot be controlled from the RSP, the licensee has included procedural direction to ensure the valve's closure via operator actions at the valve's motor control center (MCC2B237043) prior to placing RHR in the SDC or LPCI mode. However, a review of this activity found no emergency lighting to be installed at the MCC. In response, the licensee issued a CR, dated October 10, 1997, stating that 8-hour emergency lighting coverage is required for this area.

c. Conclusion

Based on the conditions noted during the plant tours and the control room evacuation procedure walkdown, the inspector concluded that conditions exist where the SSES design does not meet the emergency lighting requirements of Section III.J. of Appendix R to 10 CFR Part 50.

SSES Operating License NPF-14 (Unit 1) Condition 2.C (6) and NPF-22 (Unit 2) Condition 2.C(3) specify that the licensee implement and maintain in effect all provisions of the approved fire protection program as described in the FPRR for the facilities and as approved by the NRC SER dated August 9, 1989. The NRC based its approval of the SSES fire protection program on the licensee's commitment to follow the guidance of Appendix A to BTP APCSB 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants," and the licensee's commitment to meet Sections III.G, 111. J., and III.L of Appendix R to 10 CFR Part 50.

Section III.J of Appendix R to 10 CFR Part 50 requires that fixed, self-contained lighting, with individual 8-hour minimum battery power supplies be provided in areas that must be manned for safe shutdown and for access and egress routes to and from all fire areas.

Contrary to the above, as of November 7, 1997, the licensee could not demonstrate that it had adequate emergency lighting for (1) checking the RWCU system for leakage, (2) opening breaker 1Y219-018 to stop RWCU leakage or diverting reactor water to radwaste or the condenser via RWCU, or (3) closing flow control valve HV-243-F023A at motor control center 2B237043. In addition, the required ELUS in the E diesel generator building were not receiving appropriate testing and maintenance. Therefore, these failures to meet the Appendix R requirements for ELUS are identified as an unresolved item, Failure to provide post-fire safe shutdown lighting in areas and have a program that assures the operability of lighting in the "E" diesel building. (Unresolved Item 50-387, 388/97-201-07)

F6.5.2 Communications

a. Inspection Scope

Appendix A to BTP APCSB 9.5-1 specifies that fixed emergency communications be available. The licensee's SSA commits to maintaining a voice-powered communications system to provide uninterruptible communication from the MCR and RSPS to numerous locations throughout the plant. The team assessed the adequacy of the communications provided for implementing various required post-fire safe shutdown operator actions, as well as between operations and the fire brigade.

b. Observations and Findings

During the onsite inspection the licensee was requested to provide documentation that demonstrated that communications were evaluated and properly integrated into the SSA. Of particular interest to the inspection team was that all manual actions required to support safe shutdown of the plant were identified and addressed. In response to this request, the licensee provided calculation EC-01 3-0563, Rev. O, dated June 3, 1994, to the inspection team. In review of this calculation, the team compared the Appendix R manual operations stated in DCN 96-0117, dated March 14, 1996, E-690, to the communications areas listed in EC-013-0563. Review and comparison of these documents by the inspection team did not reveal any inconsistencies.

c. Conclusion

Based on the its review, the team found that the communications provided to support post-fire safe shutdown from outside the MCR was adequate and satisfied the SSA commitments. Therefore, within the areas inspected, the team did not identify any conditions that it considered to be program weaknesses.

F6.6 IPEEE Fire Risk Analysis

a. Inspection Scope

For the plant areas noted below, the team assessed the reasonableness of the licensee's IPEEE assumptions, analysis methodology, and results.

b. Observations and Findings

Room with 125V dc Distribution Panels (Zone O-28 B-11)

Simultaneous loss of these 125V dc distribution panels (one due to fire, the other due to random failure) is the largest contributor to fire-induced core damage frequency (CDF) in the SSES 1 PEEE. There are several problems with the treatment of this room. First of all, SSES did not model fire damage from short-term transient fires (i.e., not fixed or long-term) since it claims industry data and SSES'S good housekeeping practices make such fires insignificant. Also, the ignition frequency for this room included a long-term transient component which takes into consideration good housekeeping by SSES. The licensee's analysis assumes that good housekeeping reduces the ignition frequency.

Because of the allowance of transient combustibles by administrative limits, short-term transient fires should not be assumed to be insignificant. It is recommended that these fires be modeled, with appropriate reductions in frequency considering their likelihood. In fact, it is recommended that fires governed by the administratively established limits on transient combustibles be modeled in all areas in the plant.

Crediting good housekeeping at every potential avenue is too optimistic and unrealistic. A regional fire inspector found a fire load of highly flammable paint over approximately 1500 square feet (in Unit 1 RHR pump room), which translates to approximately 2.4E7 BTU. Unattended vacuums and mops were also found in the plant. Thus, significant combustible sources and unattended combustible sources discredit the assumption that good housekeeping will keep short-term transient sources insignificant.

Control Room

Unit 1 was the only unit modeled in the IPEEE. For Unit 1, the 1 C601 cabinet is partitioned by single steel barriers into three subsections. According to the IPEEE, fire in one subsection cannot spread to another. As a result, the 1 C601 ECCS cabinet was screened out from the IPEEE analysis.

Upon inspecting the plant, the team found penetrations in the metal barriers separating each subsection. In addition, a common trough lies beneath all sections of the Unit 1 ECCS cabinet. The cables from each cabinet feed directly into this trough. No floor separates these cabinets from this trough. Most cables in these cabinets have fire-resistant tubing around them. According to the licensee's probabilistic risk assessment (PRA) specialist, cables penetrating dividers are protected by flexible conduit on. one side of the penetration. According to the I PEEE, these cables are either IEEE-383 or equivalent. It was noticed that one set of cables beside the metal wall in one of the sections was unprotected by tubing.

Actually, this common trough continues through OC653 and into Unit22C601 ECCS cabinet. Observations about the Unit 1 ECCS cabinet apply to the Unit 2 cabinet.

Flexible fire-resistant conduit on one side of the penetration will not stop fire from propagating. Unprotected cables beside the metal walls are susceptible to fire via conduction of heat through the metal barrier. In addition, hot cable and tubing could drop into the trough and ignite a cable fire. In both scenarios, the entire Unit 1 ECCS cabinet would be susceptible to a single fire. The trough is more troublesome since it threatens the Unit 2 ECCS cabinet also. It is recommended that the loss of the entire Unit 1 ECCS cabinet be modeled, and the likelihood of damage to all cabinets on the trough be evaluated. Loss of an entire ECCS cabinet has the potential to be the most severe IPEEE sequence.

Cable Spreading Rooms, Upper and Lower

Both cable spreading rooms (CSRS) were screened out of the IPEEE as lacking combustibles. According to the IPEEE, IEEE-383 or comparable cable is found in the cable spreading room. Inspections found electrical cabinets in the rooms. It was also noted that hot work is allowed in the room. In fact, the IPEEE indicates that welding and cutting at power is an ignition source for the CSR. Administrative limits also allow transient combustibles.

IEEE-383 cable is combustible. Ignition sources such as electrical cabinets exist, maintenance on those cabinets is done, and welding and grinding are allowed. Therefore, the cable spreading rooms should not be screened out on a qualitative basis and should be evaluated on a quantitative basis.

Multi-Compartment FireThreat

A fire door is installed in the fire barrier wall that separates control structure fire areas O-28 B-I and O-28 B-11. Inspection of the door showed it to be properly installed and sound.

The team determined that the fire barrier separating fire areas O-28 B-I and O-28B-II meets its fire rating. The licensee's analysis did not make any recommendations with regard to improving the fire resistance of the barrier. The team noted that the IPEEE does not utilize a failure probability for barriers and, therefore, the analysis does not quantify the potential for a multi-compartment fire threat.

Relay Rooms, Upper and Lower

Detection for the carbon dioxide suppression system in the upper and lower relay room was discovered to have no cross-zone protection against actuation. The risk significance" of"inadvertent actuation was evaluated using a conditional generic damage probability (given an actuation) from NUREG/CR-5580, a carbon dioxide suppression system inadvertent actuation frequency from SSES, and a conditional core damage probability derived from the NRC Accident Sequence Precursor analysis. In each case, all equipment related to the relays in the room is assumed to fail due to suppression actuation.

The inadvertent actuation of the carbon dioxide system in a relay. room was not found significant. This conclusion is based upon presence of both divisions of ADS and one division of CS and RHR, along with CRD to mitigate an accident upon loss of a relay room. No recommendations exist.

c. Conclusion

The team identified several weaknesses with the IPEEE fire analysis and its assumptions. These weaknesses can be categorized as follows:

- Large fires due to combustibles allowed by administrative limits are not modeled. It is the team's recommendation that large fires be modeled with appropriate " frequencies to take into account that they are less likely than the most likely smaller fires which were exclusively considered. The team could not establish, that this recommended approach of modeling large fires had been considered for cabinet fires.

- The cable spreading room has been screened out due to the lack of combustibles. However, it should be noted that cables in the cable spreading room are combustible. In addition, transient combustibles are allowed in the room by procedure, and ignition sources exist in the room, and hot work is allowed by procedure. The team does not agree with the screening of this room.

- Cabinet 1 C601, the ECCS cabinet in the control room, can potentially be damaged in a single fire due to penetrations between cabinet sections. This fire was ruled out since these penetrations were overlooked by the IPEEE. Fire can propagate through these penetrations and via the common trough (falling, burning cable), and unprotected cables along the wall can catch fire. This sequence has the potential to be the most severe fire sequence.

Therefore, these conditions are identified as a program weakness, Failure of the IPEEE to consider the potential operational plant conditions or fire conditions which propagate into a large fire.

V. Management Meetinas

X I Exit Meeting Summary

The inspectors presented the inspection results to members of licensee management at the conclusion of the inspection on November 7, 1997. The licensee acknowledged the findings presented.

The inspectors asked the licensee whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

PARTIAL LIST OF PERSONS CONTACTED

Licensee Personnel

Name	Title	Organization
M. Adelizzi	Operations Representative	PP&L
P. Brady	FPFI Project Manager	PP&L
N. Bishop	Senior Information Specialist	PP&L
C. Burke	System Engineer	PP&L
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F. McCreesh	Fire Protection Engineer
B. Melley	Fire Protection Engineer

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NRC

R. Deem	Team Member - Nuclear Systems Engineer, BNL
R. Fuhrmeister	Team Member - Fire Protection Inspector, Region I
J. Hyslop	Team Member - PRA/IPEEE Analyst, SPSB, NRR
K. Jenison	Senior Resident Inspector
P. Madden	Team Leader - Senior Fire Protection Engineer, NRR
L. Marsh	Chief, SPLB, DSSA, NRR
J. Richmond	Resident Inspector
W. Ruland	Chief, Electrical Engineering Branch, Region 1
M. Salley	Team Member - Fire Protection Engineer, NRR
K. Sullivan	Team Member - Electrical Systems Engineer, BNL
S. West	Chief, FPES, SPLB, DSSA, NRR

LIST OF ACRONYMS USED

ADS	Automatic Depressurization System
AFFF	Aqueous Film Forming Foam
APCSB	Auxiliary Power Conversion Systems Branch
ASO	Auxiliary System Operator
ASTM	American Society of Testing Materials
AUS	Auxiliary Unit Operator
BTP	Branch Technical Position
BNL	Brookhaven National Laboratory
BWR	Boiling Water Reactor
CDF	Core Damage Frequency
CFR	Code of Federal Regulations
CMEB	Chemical Engineering Branch
COR	Code of Record
CR	Condition Report
CRD	Control Rod Drive
Css	Core Spray System
CTS	Condensate Transfer System
CST	Condensate Storage Tank
Cwo	Construction Work Order
DCN	Design Change Notice
DCP	Design Change Package
DSSA	Division of Systems Safety and Analysis
ECCS	Emergency Core Cooling System
ELU	Emergency Lighting Unit
EOP	Emergency Operating Procedures
ESSW	Emergency Safeguards Service Water
ESW	Emergency Service Water
FM	Factory Mutual
FPES	Fire Protection Engineering Section
FPFI	Fire Protection Functional Inspection
FPRR	Fire Protection Review Report
FSAR	Final Safety Analysis Report
GDC	General Design Criterion
GDG	General Design Guidance
GE	General Electric
GL	Generic Letter
gpm	Gallons Per Minute
HVAC	Heating Ventilating and Air Conditioning
HPCI	High Pressure Core injection
I&C	Instrumentation and Control
IEEE	institute of Electrical and Electronic Engineers
IOM	Installation and Operation Manual
IN	Information Notice
IPEEE	Individual Plant Examination of External Events
LCO	Limiting Condition for Operation

LIST OF ACRONYMS USED - Continued

LOCA	Loss of coolant accident
LCSR	Lower Cable Spreading Room
LOOP	Loss of Offsite Power
LPCI	Low Pressure Core Injection
MAERP	Mutual Atomic Energy Reinsurance Pool
MCC	Motor Control Center
MCR	Main Control Room
MHIF	Multiple High Impedance Faults
MOV	Motor-Operated Valve
MSIV	Main Steam Isolation Valve
NDAP	Nuclear Department Administrative Procedure
NEI	Nuclear Energy Institute
NFPA	National Fire Protection Association
NLO	Non-1 icensed Operator
NPO	Nuclear Plant Operator
NPSH	Net positive suction head
NRC	Nuclear Regulatory Commission
NRR	Office of Nuclear Reactor Regulation
ON	Off-Normal
P&ID	Pipe and instrument Drawing
Pco	Plant Control Operator
PCR	Plant Change Notice
PFSSD	Post-Fire Safe Shutdown
PGCC	Power Generation Control Complex
PP&L	Pennsylvania Power and Light
PRA	Probabilistic Risk Assessment
psi	pounds per square inch
psig	pounds per square inch gauge
QA	Quality Assurance
QC	Quality Control
RCIC	Reactor Core Isolation Cooling
RCS	Reactor Coolant System
RG	Regulatory Guide
RHR	Residual Heat Removal
RHRSW	Residual Heat Removal Service Water System
OR	Reactor Operator
rpm	revolutions per minute
RPS	Reactor Protection System
RPV	Reactor Pressure Vessel
RSP	Remote Shutdown Panel
RTD	Remote Thermal Detector
RWCU	Reactor Water Clean-up
s o	Station Black Out
SCBA	Self-Contained Breathing Apparatus
SCN	Specification Change Notice

LIST OF ACRONYMS USED - Continued

SDC	Shutdown Cooling
SER	Safety Evaluation Report
SFPE	Site Fire Protection Engineer
SPLB	Plant Systems Branch
SPC	Suppression Pool Cooling
SPSB	Probabilistic Safety Assessment Branch
SRO	Senior Reactor Operator
SRV	Safety Relief Valve
Ss	Shift Supervisor
SSA	Safe Shutdown Analysis
SSCL	Safe Shutdown Component List
SSES	Susquehanna Steam Electric Station
STA	Shift Technical Advisor
TAF	Top of Active Fuel
TCN	Test Change Notice
TIP	Traveling Incore Probe
TS	Technical Specifications
TSI	Thermal Science, Inc.
TVA	Tennessee Valley Authority
UL	Underwriters Laboratories, Inc.
WA	Work Authorization

INSPECTION PROCEDURES USED

IP 64100	Post-fire Safe Shutdown, Emergency Lighting and Oil Collection Capability at Operating an Near-term Operating Reactor Facilities
1P 64150	Triennial Post-fire Safe Shutdown Capability Reverification
IP 64704	Fire Protection Program
TIXXXX	Fire Protection Function Inspections

ITEMS OPENED, CLOSED, AND DISCUSSED

This report categorizes the inspection findings as unresolved items in accordance with the NRC Inspection Manual, Manual Chapter 0610. An unresolved item (URI) is a matter about which additional information is required to determine whether the issue in question is an acceptable item, a deviation, a nonconformance, or a violation. The NRC Region I office will issue any enforcement action resulting from its review of the URIS. With respect to this inspection, the items identified as program weaknesses are program implementation or administration problem areas which could potentially lead to noncompliance or nonconforming conditions.

Opened/Discussed

URI 50-387, 388/97-201-01	Failure to follow plant administrative control procedures in the essential safeguards service water (ESSW) pump house (see Report Section F1.1).
Program Weakness	Fire brigade effectiveness to control and extinguish a flammable or combustible liquids fire impacted by the policy to restrict the use of fire fighting foam on site (see Report Section F2.1. 1).
Program Weakness	Fire brigade's effectiveness to control and suppress a fire during a drill exercise impacted by equipment logistics and deployment problems (see Report Section F3.3).
Program Weakness	Failure to meet NDAP-QA-0445 procedural requirements for annual physical for fire brigade members (see Report Section F4.1).
URI 50-387, 388/97-201-02	Post-fire safe shutdown methodology does not assure availability of keepfill system to prevent water hammer in the HPCI, RCIC, CSS, and RHR system discharge piping (see Report Section F6.1.1).
URI 50-387, 388/97-201 -03	Failure of the automatic depressurization system core/spray (ADS/CS) post-fire safe shutdown methodology to meet the Appendix R reactor performance goals by maintaining the reactor water level above the top of active fuel (see Report Section F6.1 .1).
URI 50-387, 388/97-201-04	Failure to identify preferred post-fire safe shutdown instrumentation and required post-fire safe shutdown actions in procedures used for post-fire safe shutdown from inside the control room (see Report Section F6.2. 1).

ITEMS OPENED, CLOSED, AND DISCUSSED (continued)

URI 50-387,388/97-201 -05	The design and installation of standpipe and hose systems do not appear to meet the criteria of NFPA 14-1974 (see Report Sections F6.4.1, F6.4.3, and F6.4.5).
URI 50-387,388/97-201-06	The operational suppression capability of the CO_2 systems has never been demonstrated by code-required system full discharge tests (see Report Section F6.4.4).
URI 50-387, 388/97-201 -07	Failure to provide post-fire safe shutdown lighting in areas and have a program that assures the operability of lighting in the "E" diesel building (see Report Section F6.5.1).
Program Weakness	Failure of the IPEEE to consider the potential operational plant conditions or fire conditions which propagate into a large fire (see Report Section F6.6).

Table 1- Redundant Train Cable Separation Evaluation

SSD FUNCTION	COMPONENTS	COMMENT
Decay Heat Removal (Hot Shutdown) and RPV Level Control	RHR pumps - control circuits 1 P202B (Unit 1) and 2P202B (Unit 2)	In the event of fire in areas requiring DIV II shutdown (Path 3), RHR pumps 1 P202B and 2P202B must remain available to support suppression pool cooling of both units. Comparison of cable routing information for control cables associated with these pumps and fire area compliance methodologies developed by SSES determined that adequate separation or fire protection features (e.g., fire protective wrap) have been provided.
	RHR service water valves 1 F073B and 1 F075B	Series-connected, normally closed motor operated valves - are a potential flow diversion path. Separation and analysis methodology/assumptions acceptable.
	RCIC flowpath valves HVE511 F022 (RCIC Test line to CST) andHVE511FO11 (CST Valve)	Series-connected, normally closed motor operated valves - are a potential flow diversion path. Separation and analysis methodology/assumptions related to potential for flow diversion through series-connected MOVS acceptable.
	RCIC steam admission valves HVE511 FO07 andHVE511 FO08	Series-connected, normally open, MOVS - required open to ensure availability of RCIC in non-fire-affected unit. Separation and analysis methodology/assumptions acceptable.
RPV Level Indication	RPV wide range level transmitters LT-14201A (DIV 1) and LT-14201B (DIV 11)	Separation acceptable - configuration conforms to approved deviation (Deviation No. 27), ,
Essential Environmental Support	ESW HVAC - supply fans 1V506B and 2V506B	Separation acceptable.

Table 2: PP&L Resolution for Potentially Affected Unit 1 Valves (Ref. IN 92-18)

UNIT 1 VALVES REQUIRING MODIFICATION FOR IN 92-18 CONCERNS				
System	Valve ID	Function	Disposition	Resolution
RHR	HV-I 51 -FO03B	HX outlet valve	Alternate shutdown (Path 2)RCIC MOVS may be damaged as a result of IN 92-18 scenario before isolation at RSP. However, in that case thereactor could be repressurized using SRVS available on RSP, RHR in LPCI mode for RPV makeup, and suppression pool cooling accomplished by alternate shutdown cooling mode of RHR. To preserve this capability damage to the RHR system valves shown here must be prevented. All valves are required to be available to support operation of RHR system for decay heat removal or low pressure makeup.	Relocate Torque/Limit switches
	HV-151-FO04B	Pmp 1 B supp pool suction valve		Relocate Torque/Limit switches
	HV-151-F015B	Injection inboard iso. valve		Rewire existing interposing relays
	HV-151-F017B	Injedton outboard iso. valve		Relocate Torque/Limit switches
	HV-151-F047B	HX inlet valve		Relocate Torque/Limit switches
	HV-151-F048B	HX bypass valve		Relocate Torque/Limit switches
RHRSW	HV-1121OB	RHR HX 1 B SW inlet valve	Valve must open to allow RHRSW flow through RHR HX. Damage to valve must be prevented.	Relocate Torque/Limit switches
	HV-11215B	RHR HX 1 B SW outlet valve		
RX RECIRC	HV-143-F023B	RX recirc pmp B suction valve	Valve located inside contmt. and must close to prevent short cycling of shutdown cooling flow. Inability to close will affect DHR capability of RHR.	Relocate Torque/Limit switches
ESW	HV-01222B	ESW spray pond bypass valve	Normally open; required closed. Damage to valve must be prevented.	Relocate Torque/Limit switches
	HV-01224B1	ESW spray pond header valve	Normally closed; required open. Damage to valve must be prevented.	

UNIT 2 VALVES REQUIRING MODIFICATION FOR IN 92-18 CONCERNS				
System	**Valve ID**	**Function**	**Disposition**	**Resolution**
RHR	HV-251-F003A	HX outlet valve	Alternate shutdown (Path 2)RCIC MOVS may be damaged as a result of IN 92-18 scenario before isolation at RSP. However, in that case the reactor could be depressurized using SRVS available on RSP, RHR in LPCI mode for RPV makeup, and suppression pool cooling accomplished by alternate shutdown cooling mode of RHR. To preserve this capability, damage to RHR system valves shown here must be prevented. All valves are required to be available to support operation of RHR system for decay heat removal or low pressure makeup.	Relocate Torque/Limit switches
	HV-251-F004A	Pmp 1A Supp Pool Suction valve		Relocate Torque/Limit switches
	HV-251-F015A	Injection inboard iso. valve		Rewire existing interposing relays
	HV-251-F017A	Injection outboard iso. valve		Relocate Torque/Limit switches
	HV-251-F047A	HX inlet valve		Relocate Torque/Limit switches
	HV-151-F048A	HX bypass valve		Relocate Torque/Limit switches
RHRSW	HV-21210A	RHR HX 2A SW inlet valve	Valve must open to allow RHRSW flow through RHR HX. Damage to valve must be prevented.	Relocate Torque/Limit switches
	HV-21215A	RHR HX 2A SW outlet valve		
I7X RECIRC	HV-243-F023A	RX recirc pmp A suction valve	Valve located inside contmt. and must close to prevent short cycling of shutdown cooling flow. Inability to close will affect DHR capability of RHR.	Relocate Torque/Limit switches
ESW	HV-01222A	ESW spray pond bypass valve	Normally open; required closed. Damage to valve must be prevented.	Relocate Torque/Limit switches
	HV-01224A1	ESW spray pond header valve	Normally closed; required open. Damage to valve must be prevented.	Rewire existing interposing relays

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SUSQUEHANNA STEAM ELECTRIC STATION
RESPONSE TO NRC FIRE PROTECTION FUNCTIONAL INSPECTION
NRC INSPECTION REPORT NOS. 50-387/97-201 & 50-388/97-201
PLA-4945 FILE R41-2

Docket Nos. 50-387
and 50-388

This letter provides PP&L's responses to findings identified by the NRC in their report on the results the Fire Protection Functional Inspection performed at the Susquehanna Steam Electric Station from October 20-24, and from November 3-7, 1997.

Our response is divided into three parts: Attachment 1, Responses to Unresolved Items, Attachment 2, Responses to NRC Identified Programmatic Weaknesses, and Attachment 3, Comments on or Clarifications to the Report.

Our response is formatted by first reiterating the NRC's finding or observation followed by a response thereto. Corrective actions and/or enhancements are included as a part of our response to each of the findings

There is currently a high level of activity at PP&L related to fire protection issues due to commitments made prior to the FPFI. To achieve the highest level of efficiency possible, it is our intent to integrate the completion of the corrective actions and/or improvements associated with these inspection findings with our ongoing fire protection work activities. As such, all actions will be completed by the end of the April 2000 refueling outage for Unit 1 with overall work package closeout by the end of December 2000. We look forward to a continued interaction with the staff so that we may bring all of the unresolved items to a positive and expeditious closure.

We found participation in the pilot inspection program beneficial and compliment the inspection team and staff on the professional exchange of technical ideas and insights that occurred throughout the inspection process. This input will enable us to improve the Susquehanna SES Fire Protection Program. If you have any questions, please contact Mr. W.W. Williams at (610) 774-7742.

Very truly yours,

R. G. Byram

Attachments

ATTACHMENT 1

RESPONSE TO UNRESOLVED ITEMS

NRC Unresolved Item URI 50-387, 388/97-201-01

"During a plant walkdown, in the essential safeguards service water (ESSW) pump house, the team found that Nuclear Department Administrative Procedures (NDAP) "Control of Transient Combustible/Hazardous Materials," and "Transient Equipment Controls," were not fully implemented in that plant personnel failed to adequately control transient combustible materials and to perform the appropriate engineering evaluation on securing transient equipment to plant components or structures."

PP&L Response

Non compliances identified by the inspection team were immediately corrected. Further walkdowns of the facility by plant personnel found the non-compliances identified were isolated cases with their respective programs. Additionally, effluents management personnel walked down their entire transient cleaning supply areas and found no additional non-compliances. Further, effluents management has excluded the use of the small portable plastic vacuum cleaners in the plant to ensure better control of the transient they represented.

Currently, fire protection personnel monitor the plant through periodic inspections (monthly during non-outage periods, weekly during outage periods) under NDAP-QA-0440. Additionally, NDAP QA-0014 requires a general inspection of the facility once per week.

As we believe the violations found during the FPFI were isolated cases and the use of small portable vacuums have been discontinued by effluents management, we intend to continue to use only our currently existing procedures to monitor for further violations or a trend thereof. At this time we feel no further action is necessary.

NRC Unresolved Item URI 50-387, 388/97-201-02

"The licensee's off-normal procedure states that the condensate transfer system (CTS) or other method of maintaining keepfill is required for high-pressure core injection (HPCI), reactor core isolation cooling (RCIC), the core spray system (CSS), and residual heat removal (RHR) to prevent water hammer in the discharge piping. The CTS and the cross-tie to the demineralized water system alternative keepfill scheme are not powered from a 1E bus, which would make them unavailable during a fire event that causes the loss of offsite power (LOOP). Since normal methods of maintaining keepfill were not credited by the licensee for post-fire safe shutdown, the team noted that the loss of this capability might result in excessive water hammer in required shutdown systems. To preclude such an occurrence, PP&L has developed an alternate keepfill scheme which involves the installation of a temporary cross-tie, using a hose to supply water from the

fire water system to the CTS. Since this scheme involved manual actions with staged equipment, the licensee was asked to demonstrate the scheme's feasibility. During the team's walkthrough of the procedure, tools and equipment required to make the connection between the CTS and the fire water system were not available. Additionally, the team noted that the emergency lighting in the area where actions were to be performed did not appear to be sufficient."

PP&L Response

The tools and equipment required to make the connection from the fire water line to the condensate transfer system (CTS) were staged on November 26, 1997. Since the action to connect the fire water line to the CTS was considered to be a contingency action to be taken only in the event that the specified procedural actions could not be taken, 8-hour emergency lighting has not been provided. Based on discussions with the FPFI Inspection Team, PP&L has agreed to perform additional reviews.

In the current Appendix R Safe Shutdown Analysis for SSES, PP&L gave consideration to the required time in the safe shutdown scenario when each system would be called upon to perform its safe shutdown function in determining whether or not the loss of the keepfill system would present a potential impact to safe shutdown. If in our considered judgment, the potential existed for any of the systems to drain down and be susceptible to damage due to a water hammer, a mitigating action was developed to prevent such damage.

In the current SSES Appendix R Safe Shutdown Methodology, the HPCI, RCIC, RHR and CS Systems are used in various combinations to support safe shutdown. Tables 4-2a, 4-2b and 4-2c in Section 4.0 of PP&L Calculation EC-013-0843 describe the various uses of these systems in the SSES Appendix R Safe Shutdown Methodology. Tables 4-3a, 4-3a-1, 4-3b, 4-3c, 4-3d and 4-3e provide time lines for when each of these systems will be required to operate in support of Appendix R Safe Shutdown at SSES.

Based on a review of the time lines described above, HPCI or RCIC are always initiated within 5 to 15 minutes post-fire. CS is generally initiated within the first 40 minutes, although on the non-fire unit, CS initiation could be delayed until 210 minutes. RHR is placed in service within approximately the first 40 minutes on the fire unit and around 120 minutes on the non-fire unit. Staggered operation of RHR between units may be required in order to achieve and maintain cold shutdown.

Based on the early initiation of HPCI and RCIC in support of Appendix R Safe Shutdown, PP&L concluded that the loss of the keepfill capability for the HPCI and RCIC Systems would not impact the ability of these systems to perform their

Appendix R Safe Shutdown function. Testing performed at SSES after the FPFI in the first quarter of 1998, which simulated the loss of CTS, determined that adequate discharge piping pressures were maintained in the CS system for over 24 hours. Due to similarity in piping size and check valve design between CS and HPCI and RCIC, the assumption currently used in the safe shutdown analysis that a drain down would not occur in the first 15 minutes appears to be reasonable.

When shutdown is being accomplished from the Control Room, the CS System is used somewhat later in the shutdown scenario and, as such, the potential for discharge piping to become voided and sustain damage upon system initiation was considered to be somewhat greater and, as a result, additional mitigating actions were developed. The primary action developed for mitigating the effects of a loss of ECCS and RCIC keepfill during the Appendix R fire scenario for the CS System is described below.

Procedure ON-037-001, Loss of Condensate Transfer System, in Section 3.7 instructs the operator to start one pump in each loop in minimum flow if voiding of the discharge piping is imminent. It is expected that the operator would take this action during the fire scenario upon indication from the available instrumentation that discharge piping pressures were dropping to an unacceptable level or upon loss of the instrumentation that provides this information to the Control Room. This action was intended to prevent voiding of the discharge piping for the CS System for fires in the plant where shutdown is accomplished from within the Control Room. Again, it can be noted that system drain down effects in simulated loss of CTS testing did not indicate that system drain down would be imminent for the CS System. Therefore, this approach again seems to be a reasonable means of addressing the concern for the loss of keepfill for the CS System.

In the SSES Appendix R Safe Shutdown Methodology for shutdown from within the Control Room, the RHR system is operated in the Suppression Pool Cooling mode in a staggered manner first on the fire unit and later on the non-fire unit. This is required due to restrictions on diesel generator loading. As a result, simultaneous operation of the RHR pumps on each unit may not be possible. To address this, procedural guidance was developed and included into Procedures OP-1/249-005, RHR Suppression Pool Cooling, Section 3.1.8 b. for placing RHR into the Suppression Pool Cooling when the RHR discharge piping may be voided. The operator would take this action when accomplishing shutdown from the Control Room should simultaneous operation of the RHR pumps on each unit be prohibited. The procedural steps outlined in OP-1/251-005 Section 3.1.8 b are referred to as the "slow fill" process.

For a fire in the Control Room requiring Control Room evacuation and shutdown from the Remote Shutdown Panel, the intent of the analysis was to use the RHR slow fill process whenever a loss of keepfill pressures prevent the operation of other systems available on the Remote Shutdown Panel (RSP). When the slow fill process is used for shutting down from the RSP with RHR flow path aligned to the path protected from the effects of MOV Hot Shorts as described in Appendix C to Calculation EC-013-0859, safe shutdown can be achieved and maintained without the Condensate Transfer System.

Procedure ON-037-001, Loss of Condensate Transfer System, also provides an option in Attachment A, Section 2.0 to use the fire protection system as an alternate source of ECCS and RCIC Keepfill. This option would be available for Appendix R fires since it relies upon the diesel driven fire pump, but it is considered to be a back up contingency action to the primary actions described above. Since this is a back up contingency action for mitigating the effects of such an event, PP&L considered that the installation of 8-hour emergency lighting in accordance with Appendix R, Section III.J was not required.

As a result of the discussions held with the inspection team during the FPFI, PP&L has concluded that a more positive means of demonstrating the availability of the ECCS and RCIC Systems which addresses the potential system initiation on time lines different than those assumed in the analysis and which would also monitor and account for degradation over time in the leak tightness of the pump discharge check valves is necessary. Based on this conclusion, PP&L will perform additional reviews to demonstrate that the loss of keepfill will not result in these systems being unable to function or that means are available to assure that keepfill pressures are maintained at those times when system initiation may be required in response to fire conditions. These reviews will be integrated into our fire protection work activities and will be completed by April 2000.

<u>NRC Unresolved Item URI 50-387, 388/97-201-03</u>

"The licensee was granted an exemption to use an automatic depressurization system/core spray (ADS/CS) shutdown methodology in lieu of an RCIC/HPCI high-pressure methodology. The acceptance of this method was based on the licensee's claim that this low-pressure methodology did not allow the reactor pressure vessel (RPV) water level to go below top of active fuel (TAF). In calculation EC-013-0843, the licensee stated that spurious safety relief valve (SRV) opening from fire-related damage could cause the RPV water level to go below TAF. Additionally, in calculation EC-013-0509, "Minimum Reactor Water Level Under Spurious SRV Operation During a Control Room Fire," Rev. 1, dated July 7, 1994, the licensee did a thermal-hydraulic analysis and found that the spuriously opening one or two SRVs would cause the RPV water level to go below TAF."

PP&L Response

In Deviation Request No. 33, Reactor Coolant Makeup and Depressurization Systems, PP&L stated: "...the reactor coolant makeup function will be capable of maintaining the reactor coolant level above the top of the core." In the SAIC Report attached to the NRC SER dated August 9, 1989, in regards to the acceptance of Deviation Request No. 33, the following statement is made: "...the analysis ensures that the level of the coolant will always be maintained above the top of the core." The discussion provided below explains that the statements provided above related to the reactor coolant level in the core region are correct. The discussion provided below also explains that the conclusions in Calculations EC-013-0843, EC-013-0509 and EC-THYD-1035 are correct and consistent.

Calculation EC-013-0509, Minimum Reactor Water Level Under Spurious SRV Operation..., was prepared to determine if operator actions were necessary to mitigate the effects of the spurious opening of one, two, six or seven SRV's. The purpose of this calculation was to determine if the automatic functioning of the Core Spray (CS) system was adequate for mitigating the effects of spurious SRV opening. The conclusion of this calculation was that operator actions within approximately 10 minutes to further depressurize the reactor and begin manual injection with CS was required to mitigate the effects of the spurious opening of one or two SRV's. The reason for this is that with one or two SRV's open, the reactor depressurization rate is slow enough that reactor level could go below the top of active fuel prior to reactor pressure reaching the point where automatic injection by the low pressure CS system would occur to maintain level. As a result, PP&L concluded that the automatic functioning of the low pressure CS system would not be effective in maintaining reactor level above the top of the active fuel (TAF) and to mitigate the effects of such a condition would require a manual operator action. The manual operator action is currently contained in the plant procedures. The conclusions of Calculation EC-013-0509 were summarized in Calculation EC-013-0843.

Calculation EC-THYD-1035 was prepared to determine the reactor coolant level inside the shroud during reactor vessel depressurization followed by injection with low pressure CS. In Revision 1 to this calculation performed subsequent to the FPFI, a core spray model was added and two cases were considered: (1) Automatic actuation of ADS (-129" plus a 102 second time delay) followed by low pressure make-up with one division of core spray; (2) Manual initiation (i.e. fire damages the ADS automatic actuation circuitry) of ADS by the operator when level drops to TAF followed by low pressure make-up with one division of core spray.

Although a plant fire could result in spurious actuation of individual SRV's rather than a failure of the ADS automatic actuation circuitry, this has not been specifically analyzed as a separate case because the spurious actuation of SRV's lessens the severity of the event. The rationale for not analyzing the case, which involves spurious actuation of SRV's, is as follows. If the plant fire causes an SRV to actuate early in the event, the reactor will partially depressurize by the time ADS is initiated (automatically at -129" or manually at -161") on low water level. With the pressure lower at the time of ADS initiation, the stored energy which must be removed from the coolant, the fuel, the reactor vessel, and the vessel internals to drop the reactor pressure below the CS shutoff head is smaller than it would be if the blowdown was initiated from high pressure. Consequently, the inventory loss due to coolant flashing would be smaller if ADS is initiated from low pressure as opposed to high pressure. Therefore, the cases analyzed, which did not include any spurious SRV actuations, bound the case which includes spurious SRV actuations.

The conclusions of Revision 1 to Calculation EC-THYD-1035 are that: (1) For the first case described above, the coolant level never drops below TAF. The maximum void fraction within the core during the event is approximately 0.8. The range on the void fraction axially within the core is 0.4 to 0.8 during this event with the core exit void fraction during normal operating conditions being about 0.7. Fuel clad temperatures during the blowdown closely follow the coolant saturation temperature; (2) For the second case described above, the results are virtually identical except that the minimum downcomer level is lower by 32" which is exactly the difference between the initial blowdown levels of -129" and -161".

From this it can be concluded that:

1. When using the SSES Safe Shutdown Methodology which employs the use of ADS and CS, the coolant level is always maintained above TAF.
2. The availability or lack thereof of automatic actuation circuits for ADS and CS does not alter the conditions within the reactor core.
3. The spurious opening of a single or multiple SRV's is bounded by the analysis described above and, is therefore, not a concern when shutting down at SSES based on the selected safe shutdown approach.
4. The effects of kinematic choking, should it occur, would only work to further assure that the level of the reactor coolant would remain above TAF, since, with core spray injecting from above the core, the kinematic choking effect would cause the liquid to go down through the bypass channel and to flood the core from below. This would mean that the core

spray system would be maintaining a liquid level above the core while the liquid level increased from below the core. In this scenario, coolant level is always above TAF.

NRC Unresolved Item URI 50-387, 388/97-201-04

"The licensee's off-normal procedures for post-fire safe shutdown are symptom based. These procedures direct the operators to use other off normal and emergency operating procedures (EOPs), depending on the availability of plant equipment. However, these other procedures do not take into account the impact of fire damage, including the potential for fire-induced spurious signals on shutdown systems. For example, the normal shutdown procedures would not contain cautions on the possibility that hot shorts could change valve positions or give the operators false instrumentation readings. In reviewing the licensee's procedures for implementing a safe shutdown of the plant following a fire in plant areas not requiring main control room (MCR) evacuation, the team found that preferred instrumentation and equipment that would be free of fire damage was not identified by the safe-shutdown procedures by fire area or fire zone, although this information was available in the licensee's safe-shutdown analysis (SSA). These procedures did not provide guidance regarding the manual operator actions which may have to be performed for specific fire area or zones in order to implement post-fire safe shutdown. Depending on the location of the fire, the licensee's SSA requires different post-fire safe shutdown manual actions to be performed for different fire areas."

PP&L Response

Damage to plant equipment and components as a result of a plant fire is very difficult to predict. It is a function of the size and intensity of the fire, the location of the fire, the effectiveness of the plant fire protection features in mitigating the effects of the fire, the effectiveness of the plant fire brigade in responding to the fire and the susceptibility of the equipment and components in the vicinity of the fire to fire induced damage. From a design perspective, this uncertainty drives the engineer to make conservative assumptions about the types of failure conditions that may occur for each fire location. For SSES, the fire is assumed to spread throughout the entire area and to damage any circuits within the fire area. The fire damage to each circuit is evaluated for the effects of hot shorts, open circuits and shorts to ground. The evaluation for hot shorts is conducted in accordance with the criteria contained in Attachment A to PLA-4505 dated December 6, 1996. In making these types of assumptions, the criteria applied in the SSES Appendix R Safe Shutdown Analysis is to identify any and all potential failure states and identify a means of mitigating the effects of each. From the perspective of the plant operator, however, the focus is slightly different. The plant operator needs to know all of the potential impacts that may result. The approach to shutting down the unit in the event of a fire, however, should not direct him to act as though all of these potential failures have, in fact, occurred.

The consensus best approach for operating the units due to off-normal events is to have the operator respond to the symptoms that are presented to him. For SSES, this approach is provided in the EOPs. In conjunction with the EOPs and all other plant procedures, SSES has provided a fire off normal procedure to alert the operator to the types of fire impacts that may result depending on the extent and location of fire damage and Pre-Fire Plans which provide additional details on specific types of fire response actions that are appropriate for each fire zone. The ON for the fire condition is ON-013-001.

Upon confirmation of a plant fire with the potential to impact safe shutdown of the units, ON-013-001 in Section 3.0 instructs the operator to:

1. Activate the Fire Brigade.
2. Implement the appropriate Pre-Fire Plan.
3. Enter appropriate procedures within 15 minutes. (Note: The appropriate procedures could be EOPs, ONs, OPs or GOs.)
4. Refer to Attachment A for Protected Safe Shutdown Instrumentation (Instruments protected from Appendix R fires).

Similarly, in section 5.0 of ON-013-001, information is provided to the operator on the protected safe shutdown path for each division. Attachments B through N of ON-013-001 provided additional information on the specific actions that may be required to be taken for a fire in various locations of the plant (e.g. Unit 1 Reactor Building, Unit 2 Reactor Building, Control Structure).

In addition, when appropriate, the Pre-Fire Plans for the safety related structures describe symptoms that lead to required manual actions identified in ON-013-001 for the fire zone and the protected and non-protected divisions within the fire zone.

Therefore, the information required for the operator to understand the potential impacts of fire induced damage states is provided. With the information provided in ON-013-001 and the Pre-Fire Plans for the safety related structures, the operator can determine which safe shutdown path is protected from fire damage, which safe shutdown instrumentation is protected from fire damage and, therefore, is most reliable and which actions may be required in response to potential fire damage to equipment or circuits on a fire zone basis.

Despite this, we concur with the NRC's position that improvements can be made in the organization of the information contained in the procedures by using the information currently organized in the Appendix R Safe Shutdown Analysis.

Based on this, we will revise ON-013-001 to provide within this procedure or within other procedures directly referenced from this procedure information summarizing the protected safe shutdown path and any operator actions potentially required for each plant fire zone within the Unit 1 and 2 Reactor Buildings, the Control Structure, the Diesel Generator Bays and the ESSW Pumphouse. This information will be used to supplement the operator's understanding of the potential fire impacts for each given area so that the operator can assess these impacts as he proceeds with shutdown and control of the units using the appropriate EOPs, ONs, OPs and GOs. These improvements will be integrated into our ongoing fire protection activities.

NRC Unresolved Item URI 50-387, 388/97-201-05

"The team identified issues associated with the installed fire detection system and its ability to meet the minimum installation criteria established by the applicable National Fire Protection Association (NFPA) code of record (COR). High ceilings, deep beam pockets, and detector spacing limitations should be considered simultaneously in establishing the limiting parameters of the system design. Evaluating one parameter, without considering the others, will give a false impression of the design. The licensee could not adequately demonstrate that the fire detection system in the areas inspected met minimum industry fire protection codes. Specifically, the licensee could not demonstrate that the design considered all environmental and physical aspects of the installation including, but not limited to high ceilings, effects of the ventilation system on smoke movement, obstructions, and beam pocket ceiling construction."

"The team identified plant conditions that could affect the ability of the sprinkler system to react to a fire. The team concluded that certain sprinkler systems exhibited weaknesses in meeting the NFPA COR; specifically, the COR guidance pertaining to the placement of sprinkler heads, sprinkler head coverage, and obstructions to the area of coverage."

"The team performed a walkdown of the standpipe hose stations in the control building. Susquehanna uses a Class II system as defined by the NFPA COR. The NFPA COR states: "The number of hose stations for Class II service in each building and each section of a building divided by fire walls shall be such that all portions of each story of the building are within 30 feet of a nozzle when attached to not more than 100 feet of hose." During the week of October 27, 1997, PP&L personnel walked down additional hose stations and found that the hose strainers (sic) did not meet the licensing and design basis because they could not provide the required area of coverage with the allotted 100 feet of hose."

PP&L Response

The fire detection and suppression systems at Susquehanna were originally designed and installed using the criteria found in the National Fire Protection Association (NFPA) codes in order to comply with GDC-3, issued on February 20, 1971.

The fire detection system at Susquehanna was originally designed and installed to the criteria of NFPA 72E, 1974 edition. This code provides the requirements for the performance of automatic fire detectors to insure timely warning for the purposes of life safety and property protection. The code provides direction on the location and spacing of smoke detectors for both smooth and beam construction type ceilings. This code has been applied and used at various types of facilities ranging from small office buildings to large industrial and commercial facilities. The plant construction contractor located and installed fire detection primarily based on the fixed fire hazards in particular plant areas. This practice was common in nuclear power plants of the vintage of Susquehanna.

The fire suppression systems at Susquehanna were originally installed to the criteria of NFPA 13, 1974 edition. This code provides the requirements for the performance of automatic fire suppression sprinkler systems to insure adequate control and extinguishment of fires. This code provides direction on the suppression system location and spacing.

As these two codes served as the original licensing basis, Susquehanna employed the use of qualified contractors during the construction of the plant to design and install the detection and suppression systems. In addition, the design and installation of these systems at SSES has been reviewed and found to be acceptable for their intended purpose by numerous organizations at various times during the construction and operation phases of SSES. These organizations included the Architect-Engineer responsible for the original plant design, PP&L Corporate and Plant Fire Protection Engineering Personnel, Fire Protection Engineering Personnel from those Insurance Companies providing coverage for SSES and the NRC. Based on this, we are confident that the systems, as installed, are generally consistent with the intent and accepted practice for their vintage of construction.

The Fire Protection Program at Susquehanna is based on a defense-in-depth philosophy with numerous barriers in place to ensure adequate protection of the plant, as well as, the health and safety of the public in the event of a postulated design basis fire at the plant. The Fire Protection Program is aimed at preventing fires from starting by controlling fixed and transient combustibles, detecting, controlling and extinguishing fires that do occur and assuring the ability to safely shutdown and maintain a safe shutdown condition for both units in accordance with Appendix R to 10CFR50 (Section III.G., J. and O.) for any and all plant fires. In examining your observations from the FPFI regarding the design and installation of detection and suppression, we have recognized that there are locations in the plant where apparent deviations from the code spacing requirements exist. Although in the majority of cases, we believe that the deviations are conscious and acceptable, the documentation of the basis for these deviations is not readily available. As a result, we will review the sprinkler layout and detector spacing in the safety related areas to assure that sprinkler blockage and code spacing deviations are either justified and fully documented or corrected. Below is a description of the approach that will be used for this effort.

Following the conclusion of the FPFI inspection in November of 1997, PP&L embarked on an effort to perform a comprehensive assessment of the layout of the fire detection and fire suppression systems. The first phase of this assessment involves a comprehensive walkdown of the actual detector and sprinkler installations in safety related areas at Susquehanna SES. The plant walkdown and inspection phase of this assessment is approximately 80% complete. The primary objective of the assessment is to determine the level of compliance of the existing plant fire detector spacing with the intent of NFPA 72E-1974 and the level of compliance of the existing plant suppression system layout with the intent of NFPA 13-1974. The results of this assessment will determine where apparent deviations in the installation of the currently installed systems exist and whether these deviations are justified or require additions to the installed systems.

The general type of construction used at Susquehanna for the structures within the scope of this assessment are of the beam construction type ceiling. For this type of ceiling the code states in part that "if the beams exceed 18 inches in depth and are more than 8 feet on centers, each bay shall be treated as a separate area requiring at least one detector". The ceiling in most of the plant areas evaluated have steel beams which are typically 18 to 24 inches deep and are spaced 6 to 7 feet apart. This arrangement forms "beam pockets" underneath the concrete flooring which it supports. Since the beams are typically less than 8 feet on centers, two beam pockets would form a bay as described by the code.

Many of the smoke detectors in the plant area are attached to the underside of the concrete flooring and are hence surrounded by the structural steel framing members to form the beam pocket. With two beam pockets forming a bay, one detector would be considered adequate coverage for the beam pocket it is located in as well as the adjacent beam pocket. The philosophy behind this is that smoke rising up into the beam pocket without the detector would be dispersed enough to carry over to the adjacent beam pocket with the detector and then set off the detection alarm.

Using this approach, it is reasonable that a smoke detector in any one beam pocket would detect smoke rising up into the detector installed beam pocket, as well as any smoke rising up into either of its adjacent beam pockets. Therefore, when assessing the acceptability of the detector location and spacing, this 3-beam pocket approach will be used as a general guidance for detector location compliance.

This approach will be used to identify where gaps may exist in detector coverage. Each of the areas where gaps in the coverage have been identified will be assessed for any safety implications.

The fire suppression systems will be inspected in a similar manner. The sprinkler head locations will be field verified to be installed where shown on the vendor supplied as-built drawings. The individual sprinkler heads will be examined to determine the approximate coverage they would supply in the event of actuation. Potential obstructions from ductwork, cable trays and other equipment will be field evaluated to determine any significant blockage points where adequate suppression capability may not be available.

For those areas where gaps in the detector coverage and/or blockage of the sprinkler coverage are identified, the following criteria will be used to assess whether or not the deviation is acceptable. Deviations will be further screened against the criteria described below to determine their significance:

1. The deviation in sprinkler coverage is significant when it exists over an area where a 1-hour fire rated raceway fire barrier credited in the Appendix R Safe Shutdown Analysis is installed.

2. The deviation in sprinkler or detector coverage is significant when it exists over an area where an Appendix R Deviation Request which justifies the physical separation of redundant safe shutdown equipment (i.e. Deviation Request No. 27) and which relies upon the availability of detection and/or suppression, credited in support of Appendix R Safe Shutdown is affected.

3. The deviation is significant when it exists in an area where, due to the quantity of combustibles installed in the area directly under the deviation, the condition poses a fire hazard to the safety-related equipment or cable trays in the vicinity of the deviation.

Deviations which are determined to be significant will be justified on the basis of more detailed analysis. If deviations can not be justified, they will be included in our corrective action program.

The results of the walkdowns are being documented in a series of field notes and these notes will be formally documented in a PP&L calculation which assesses the safety significance of each deviation based on the criteria described above. Any areas requiring additional detector or sprinkler coverage will be identified through this process and corrected through our plant modification process under the corrective action program.

Relative to the findings regarding the standpipe systems, PP&L, at the time of the inspection took the initiative to perform reviews of standpipe systems and found areas outside of the required coverage area. In response to those findings, PP&L issued CR 97-3650. Standpipe systems not meeting their required coverage area determined by the code are being re-evaluated under Calculation EC-013-0012. Preliminary results from the calculation indicate it will be acceptable to resolve this issue by staging additional fire hose at the hose station.

NRC Unresolved Item URI 50-387, 388/97-201-06

"From its review of CO_2 suppression systems, the team concluded that these systems, because of the lack of appropriate pre-operational system discharge testing, might not be capable of performing their intended fire control function. In addition, because of the licensee's concern about thermal shock to electrical equipment, the team concluded that the application of these systems might not meet the intent of GDC 3, "Fire Protection," of Appendix A to 10 CFR Part 50."

PP&L Response

Functional Performance Evaluation

The initial CO_2 discharge testing performed for SSES was not fully successful because of the inadvertent opening of an access door in the cable chase during testing. Because of this, the required concentrations were not achieved for the full time required. This test did, however, demonstrate the ability of the system to successfully deliver the product. This issue was identified and resolved with the NRC in the 1989 to 1992 time frame (reference NRC SER dated May 12, 1992). Due to concerns with performing a full discharge test in an operating plant, the following approach to resolving this issue was developed, implemented and accepted

1. Full scale CO_2 discharge testing was performed at an independent research facility.

2. The results of this full scale test were used to baseline an analytical computer model which was subsequently used to analyze the plant configurations. The primary purpose of this analytical computer model was to demonstrate that the required concentrations could be achieved and maintained in the areas.

3. In conjunction with the analytical model, actual room leakage tests were performed at SSES. This was done to obtain leakage values representative of the actual plant rather than relying on assumptions which, depending on their accuracy, could improperly influence the analytical results.

4. The analytical model baselined on actual full scale testing and conservative assumptions relative to leakage locations were used to document the acceptability of the CO_2 systems installed at SSES.

As a result of the FPFI, calculation EC-013-0968 was revised to include calculations for the upper and lower relay rooms in the control structure. Calculations for all of the cable chase rooms were already documented in this calculation; however, calculations explicitly for the upper and lower relay rooms were not. As was the case for the cable chases, the values for CO_2 injection time and mass injection flow were taken from vendor design calculations, which are reproduced in an appendix to the calculation. The worst case leakage model (that is, the model in which the total leakage area is divided equally between the floor and the ceiling of the room) was used in each of the calculations. The calculations were performed for the worst case environmental conditions for both summer and winter, with values for leakage area taken from PLA-3365, dated April 3, 1990 and calculation EC-013-1692. The results show that, with the exception of one case (lower relay room in worst case winter conditions), the CO_2 concentration in the room remained greater than 50% for greater than 15 minutes. The lower relay room anomaly was handled by adding a small increase to the CO_2 injection time, well within the capability of the system design parameters. The change requires the discharge time to be increased from 3 minutes and 26 seconds to 3 minutes and 45 seconds. During the last surveillance of the CO_2 System for this area, the recorded discharge time was 3 minutes and 53 seconds. This adjustment will be corrected during the next system surveillance scheduled for the first quarter of 1999.

As a result of the work performed in the calculation described above, which is based on a calculational model benchmarked to the testing performed at Factory Mutual and witnessed by a NRC representative, the system for CO_2 injection is considered to be fully capable of performing its intended design function.

As an additional measure, however, PP&L will pursue having CO_2 flow values used in Calculation EC-013-0968 for one relay room and one cable chase validated by independent source using a computer which has been validated for the purpose of demonstrating proper delivery of the product. In addition, a representative sample of CO_2 system discharge nozzle orifice sizes will be inspected to assure that the systems are installed in accordance with the design drawings. PP&L believes that the two actions described above, when combined with the actions currently completed to date, will fully validate all aspects of the analytical approach used as a substitute for full discharge testing. As s result, full discharge testing of the CO_2 Systems is SSES is not necessary.

GDC 3 Compliance

It is PP&L's position that CO_2 is the appropriate fire suppression agent for those applications at SSES where it is used. GDC 3 states "...Fire fighting systems shall be designed to assure that their rupture or inadvertent operation does not significantly impair the safety capability of these structure, systems, and components." The design of SSES uses unitized and divisionalized relay rooms which are designed as separate fire areas. The SSES Appendix R Safe Shutdown Analysis has demonstrated the ability to achieve and maintain safe shutdown for an all encompassing fire in any one of these fire areas. This situation bounds the condition of a rupture or an inadvertent operation of the CO_2 System for the area. Therefore, this system is designed to assure that a rupture or inadvertent operation of the CO_2 System does not impair the safety capability of SSES.

NRC Unresolved Item URI 50-387, 388/97-201-07

"During the team's walkdown of emergency lighting, the licensee could not demonstrate that adequate emergency lighting existed for supporting the following post-fire safe shutdown operations: (1) checking the reactor water cleanup system (RWCU) equipment for leakage, (2) opening a breaker to stop RWCU leakage or diverting reactor water to radwaste or the condenser via RWCU, and (3) closing a flow control valve at the motor control center. In addition, the required emergency lighting units in the E diesel generator building were not receiving appropriate testing and maintenance."

PP&L Response

The emergency lighting configurations questioned in the inspection were all justified as consistent with our program requirements. Our justifications are provided below.

Item (1) checking the reactor water cleanup system (RWCU) equipment for leakage: Revision 7 to Calculation EC-013-0859 in section 7.3.11 C. explains that pressure switches located in the RWCU piping on either side of the F033 valve are designed to prevent an overpressurization condition in the RWCU letdown line. This calculation also explains that all of the circuitry which is required for these pressure switches to function is located outside of the Control Room and is electrically isolated from the Control Room. Because of this design, an overpressure failure of this piping is not possible due to a Control Room fire. Therefore, there is no need to check the RWCU equipment for leakage and, similarly, there is no need for 8-hour emergency lighting in the area of the RWCU equipment. Procedure ON-1/200-009 will be revised to clarify that checking the RWCU piping for leaks is not required.

Item (2) opening breaker 1Y219-018 to stop RWCU leakage or diverting reactor water to radwaste or the condenser via RWCU: Revision 7 to Calculation EC-013-0859 explains that, even though the overpressurization circuitry designed to protect this piping from a hi/lo pressure interface is separated and isolated from the Control Room, if the Control Room fire were to cause a series of sequentially related spurious operations, including an "MOV Hot Short" failure of the RWCU containment isolation valve which is designed for operation from the Remote Shutdown Panel, a flow diversion condition could result. This flow diversion condition could occur if the fire were to cause spurious opening of either the F034 valve, letdown line to the Condenser, or the F035 valve, letdown line to Liquid Radwaste, in conjunction with a spurious opening of the F031 valve, bypass valve around the flow orifice, and the F033 valve. Should this unlikely sequence of spurious operations occur, a flow diversion condition could result in which the down stream piping pressure are below the rating on the piping and, also, below the setting on the pressure switch (PSH) which must actuate to close the F033 valve. To mitigate the effects of this unlikely sequence of spurious operations, the operator action to open breaker 18 on 1/2Y219 was previously included in ON-1/200-009. Appendix D to Calculation EC-013-0859 evaluated the required time frame for performing this action before a condition detrimental to safe shutdown develops. The conclusion is that there is no impact to safe shutdown that would require this action to be completed until 23 hours post-fire for the condition of no RWCU pumps running. Even for the condition of a RWCU pump running, which would require additional assumption regarding selective failure of circuits due to the Control Room fire, there are no impacts to safe shutdown until beyond 8 hours. Therefore, 8-hour emergency lighting is not required for this action.

Item (3) closing flow control valve HV-243-F023A at motor control center 2B237043: HV-243-F023A is the Loop A Reactor Recirculation System Pump suction valve. Since RHR Loop A for the Shutdown Cooling (SDC) mode and low pressure injection mode (LPCI) returns flow to the reactor vessel through the Loop A Reactor Recirculation System piping, valve HV-243-F023A must be closed to prevent short cycling of the RHR flow back through the Recirculation piping and away from the flow path which goes through the reactor core. For the SDC mode of operation, short cycling of the RHR return flow could result in an additional heat up and re-pressurization of the reactor core. When shutting down from the Remote Shutdown Panel (RSP), this condition would not present an impact to safe shutdown since a re-pressurization of the reactor would allow the re-use of RCIC for inventory make up. If RCIC were not available because SRV's were open, RHR could be used in the alternate shutdown cooling mode of operation to maintain the reactor in a stable condition with core cooling being accomplished through natural circulation. Either of these conditions could be maintained for well beyond 8 hours with no impact to safe shutdown. Therefore, 8-hour emergency lighting for the operation of this valve is not essential to achieving safe shutdown within the required 72-hour time frame. Despite this, 8-hour emergency lighting has been added for the operation of this valve. DCP 97-9140 installed emergency lighting to support operator actions at MCC 2B237 breaker 43B. This was completed on 4/3/98.

Additional Item ELUs in the E diesel generator building: Testing of the ELUs in the E diesel generator building was completed on 11/7/97. All of the emergency lights necessary to support the operator actions performed in response to Appendix R Safe Shutdown were found to be in proper working order. Batteries in three (3) lights not required for Appendix R actions required replacement. Replacement was completed on 11/18/97. All of E diesel generator building ELUs have been incorporated into the Appendix R Emergency Lighting Preventive Maintenance Procedure MT-007-002. This action was completed on June 30, 1998.

ATTACHMENT 2

RESPONSES TO NRC IDENTIFIED PROGRAMMATIC WEAKNESS

NRC Identified Programmatic Weakness: "The team found the fire brigade equipment disorganized and not ready to be rapidly transported to the fire scene and promptly deployed. Problems with equipment logistics and deployment could affect the fire brigade's ability to control and extinguish a fire in a timely manner."

PP&L Response

The fire brigade equipment storage locations are all equipped and organized in a similar manner. A specific location is identified for turnout gear, flashlights, SCBA, handtools, nozzles, etc. The current practices for standard designated storage locations of fire brigade personal protective equipment have been re-evaluated. Enhancements to aid in timely dress-out and access to fire brigade equipment have been implemented. Appropriate changes will be made to the brigade procedures to clearly identify the standard designated storage of personal protective equipment by the end of the third quarter of 1998.

NRC Identified Programmatic Weakness: "The team also noted that the licensee has prohibited the use of fire fighting foam on site; this was considered a weakness. In the event of a fire involving flammable or combustible liquids, the use of fire fighting foam can improve manual fire control and extinguishment effectiveness and at the same time provide re-flash protection to fire brigade personnel."

PP&L Response

Fire fighting foam is not used at Susquehanna SES because SER dated April 1981 and Amendment 27 to the FSAR, excludes the installation of fire protection foam anywhere in the plant. This exclusion was based upon concerns associated with storage and handling of new fuel on site.

In spite of the exclusion, we have evaluated the use of foam to determine if its use would provide any significant enhancement to our fire fighting capabilities. the following conclusions were drawn from our evaluation:

1. Fire fighting foam use for the types of fires expected at Susquehanna SES would not significantly add to the effectiveness of the manual fire fighting effort. The Fire Protection Handbook 18th Edition, in Section 22 states that one criteria that must be met for a foam to be fully effective is that the liquid must be a horizontal surface fire. The reference hazards on the Susquehanna site (e.g., turbine oil, hydrogen seal oil, and transformers) generally will be three dimensional or pressure fires. Three-dimensional (falling fuel) or pressure fires cannot be extinguished by foam unless the hazard has a

relatively high flash point and can be cooled to extinguishment by the water in the foam.

2. As stated above, the reference hazards on the Susquehanna site (e.g., turbine oil, hydrogen seal oil, and transformers) generally will be three dimensional or pressure fires. In addition, all of the referenced hazards have pre-action or deluge sprinkler protection. The use of manual fire fighting foam in a sprinkler protected area is not an appropriate application. The discharge of the sprinkler system would break up the foam blanket, making the foam ineffective.

3. The fire brigade at Susquehanna SES is trained to extinguish combustible liquid fires using hose streams only, fire extinguishers only, or a combination of the two.

Based upon the above findings, we have concluded that there is practically no value to pursuing the use of foam on the SSES site. As such, there is no justification for pursuing changes to our licensing basis to permit its use.

NRC Identified Programmatic Weakness: "The team observed a fire brigade unannounced drill. This drill scenario was a fire in the B diesel generator room. Since the diesel generators are accessed from the outdoors, the fire brigade van was used to provide support equipment. It took the brigade 23 minutes to get ready and into position with a hose line to enter the diesel generator room. A critique was held immediately after the drill. The most significant issue identified during the critique was that the brigade leader couldn't understand the transmissions from personnel wearing self-contained breathing apparatus (SCBAs). After the critique, the team noted the extensive amount of time required for the first hose team to reach the fire area and the general uninterested attitude exhibited by the brigade members."

PP&L Response

The onsite manual fire fighting capabilities meet the SSES licensing commitments. The current brigade of Operations and Security continues to prove through training/practice (classroom and hands-on) and drills that they are capable of handling a fire at SSES.

Fire Brigade unannounced drills are being enhanced by limiting the amount of simulation and closer monitoring of response times. Drill evaluation criteria are being upgraded to provide more objective expectations including timeliness. Initial expectations of timeliness, teamwork, and drillsmanship have been reviewed with fire brigade members during second quarter fire brigade quarterly meetings and at post fire drill critiques.

Management awareness has been increased in Operations, Security, and Nuclear System Engineering regarding the importance of these issues. The conduct and evaluation of fire brigade drills will be enhanced through increased participation by line supervision during the third quarter of 1998. This will provide appropriate management oversight to immediately address any identified issues.

NRC Identified Programmatic Weakness: *"The team noted that the Nuclear Training Department does not track the physical (medical) examinations of the fire brigade members. However, if a physical is overdue, the member's name appears on the monthly fire brigade report. Operations Department had changed over to biennial physicals for fire brigade members in 1995. The entire operations fire brigade complement received its first biennial physicals in 1996. The team pointed out that the NDAP procedure requirements still called for annual physicals and the basis for this change was questioned. The change to biennial fire brigade physical examinations does not satisfy the medical criteria established by industry standards and NRC fire protection program guidelines or requirements for the fire brigade members to have annual physical examinations, as established by plant procedure."*

PP&L Response

The controlling procedures, NDAP-QA-0625 and NDAP-QA-0653 have been revised to require annual physicals for fire brigade members. All fire brigade members have had their 1998 physicals completed except for five Operations members who are scheduled for October 1998. By the end of 1998, all fire brigade members will be back on an annual cycle for physicals.

NRC Identified Programmatic Weakness: *"The team's review of the depth and scope of the fire protection program audits determined that they did not fully assess compliance with Appendix R. The 1994, 1995, and 1996 fire protection program audits did not perform audit samples in the following areas: design basis reverification of plant fire protection features; reverification of the fire-induced electrical fault evaluation and the electrical-engineering aspects of Appendix R (e.g., fuse breaker coordination, common enclosure, spurious equipment operations); reverification of systems and logic used to support the safe-shutdown methodology and the fire protection features for those systems; reverification and evaluation of operational implementation of the safe-shutdown analysis; evaluation of major plant modifications for potential impact on the plant fire protection program and/or the plant safe-shutdown analysis."*

PP&L Response

PP&L has evaluated the methodology and approach used in scoping and performing the annual, biennial and triennial fire protection audits required by Technical Specification Section 6.5.2.8 and have concluded that although the audits address the elements recommended in Enclosure 3 of Generic Letter 82-21, improvements could be made in evaluating the technical and design basis areas of the fire protection system.

To this end we have engaged the services of an outside consulting organization to support the 1998 fire protection audit. A segment of their support consists of a system engineer who has the expertise and background to evaluate and challenge the fire protection system design basis. This includes the SSES position relative to Appendix R, our safe shutdown methodology and compliance with Generic Letter 86-10.

NRC Identified Programmatic Weakness: *"The team verified that RPV level and temperature instruments identified in the EOPs are not necessary to satisfy a literal interpretation of Appendix R requirements and Staff guidance and that failure to perform repair activities specified in the procedures would not preclude the ability to achieve and maintain post-fire safe shutdown (PFSSD). However, from discussions with plant operators it appears that the availability of these instruments would significantly enhance the shutdown capability. As a result it is expected that during a fire event operators would request plant instrumentation and control (I&C) technicians to perform the repair activities as specified in the procedure. Based on a walkdown of procedural actions necessary to perform the repairs, it was determined that actions necessary to install the temporary RPV temperature indication were not feasible; technicians would need to erect scaffolding and work in a high-radiation area (straddling a RHR line that is approximately 20 feet off the floor). In addition, there was no emergency lighting, and equipment and tools necessary to perform repairs were not dedicated for use."*

PP&L Response

We agree with the NRC's position described in section F6.2.2 of the FPFI Inspection Report that the instruments identified in ON-1/200-009 are not necessary for Appendix R Safe Shutdown.

We have reviewed with our Operations Management and Operations Training Personnel our current approach for obtaining RPV level and temperature information when achieving shutdown from the Remote Shutdown Panel. The conclusion reached is that the current procedures are acceptable and no enhancements are necessary. The reasons for this conclusion are as follows:

1. In an actual event requiring Control Room evacuation, equipment available on the Remote Shutdown Panel, even when worst-case fire damage is postulated, would allow the plant to be maintained in a stable condition without the information provided through implementing the subject procedures for a period of time beyond 36 hours, if necessary.

2. For this plant condition, the Emergency Plan would be implemented. Manning requirements associated with E-Plan require complete staffing within 90 minutes.

3. Once the E-Plan is fully staffed, accomplishing the actions outlined within the subject procedures could be completed well within the required time frame.

NRC Identified Programmatic Weakness: *"The team identified several weaknesses with the Individual Plant Examination of External Events (IPEEE) fire analysis and its assumptions: (1) large fires due to combustibles allowed by administrative limits are not modeled, (2) the cable spreading room has been omitted from the analysis as lacking combustibles even though cables in the cable spreading room are combustible and transient combustibles are allowed in the room by procedure, and (3) the emergency core cooling system (ECCS) cabinet in the control room has penetrations between cabinet sections and can potentially be damaged in a single fire."*

PP&L Response

The IPEEE is a qualitative review of core damage risk from external events and internal fires at power operation. This qualitative focus is in keeping with the NRC Request for Information contained in G.L. 88-20, Supplement 4, which initiated the IPEEE for SSES. Guidance provided in the Supplement indicates that significant judgment is allowed in both scope and level of analytical detail in completing the study. In completing the IPEEE fire PRA, PP&L exercised this judgment with regard to the determination of fire-risk significant areas. Based on historical fire data from the industry in general, and SSES in particular, fire effects modeling, and plant walkdowns, the most risk-significant fires were determined, not always quantitatively. That is, judgment was used to exclude certain fires/fire areas as not risk significant. Because of the low historical risk seen from small combustible sources (mops, etc.), the constant occupation of the control room, the lack of self-ignited cable fires, etc., the areas identified in the FPFI report as deficiencies in the IPEEE fire study were judged low risk. The cumulative risk in these areas was not quantified, again in keeping with the qualitative focus of the IPEEE. Small fires growing to large fires was not considered to be a realistic assumption, based on the design, construction, and operation of SSES.

Specifically, the trough in the bottom of control room cabinet 1C601 was recognized at the time of the IPEEE, but judged to be not risk significant for the following reasons. The trough was considered part of the "underfloor" area of the control room protected by CO_2. The cables entering this area are large and are not stripped of insulation until well into the cabinet area. The fire resistance of the insulation (IEEE-383 qualified) and tight geometry of the entry makes fire conduction along the trough difficult. The constant manning of the control room and tendency for fires to propagate upward also contribute to low trough fire probability. No historical evidence of control room trough fires was found. The above listed factors indicated to the IPEEE analysts that this trough does not create or contribute significantly to fire risk.

The results of the IPEEE represent a "snapshot" of the conditions that existed at SSES at the end of 1993. While the SSES fire protection program is expected to ensure that any changes to the plant do not result in unacceptable fire risk, any changes to the plant since the completion of the IPEEE (e.g. painting, etc.) are not reflected in the risk profile from the IPEEE. The IPEEE is expected to be audited by members of the NRC staff in August, 1998. While wholesale updating of the fire PRA is not anticipated, selected areas are expected to be revisited to study the impact of various assumptions on the fire PRA results. In preparation for this audit, the specific concerns presented in FPFI Report will be addressed, including re-quantification of risk, if judged appropriate.

ATTACHMENT 3

COMMENTS ON OR CLARIFICATIONS TO THE REPORT

1. NRC Observation (Report Section F6.1.1): *"The licensee is considering changing the designation of this shutdown path to "alternative shutdown" in accordance with Appendix R, Section III.L."*

PP&L's Comment: Consideration was given to changing the designation on the SSES shutdown path which employs ADS and CS from redundant, governed by the requirements of Appendix R Section III.G.2, to alternative, governed by the requirements of Appendix R Sections III.G.3 and III.L, based on the NRC's statement that partial core uncovery using ADS and low pressure systems was already approved as an alternative shutdown path. Changing the shutdown path to this designation, however, was not selected as the best option for the reasons identified below.

The use of ADS and CS at SSES, as described above, neither satisfies the definition for alternative shutdown provided in Appendix R Section III.G under footnote 2, nor meets the requirement of Appendix R Section III.G.3 for independence from the room, zone or area under consideration. Based on this, changing the shutdown path designation to alternative could lead to future confusion regarding compliance with Appendix R for this and other aspects of our Fire Protection Program.

Our understanding of the requirements of Appendix R and associated guidance is explained by our approach in performing the safe shutdown analysis for SSES. In performing the post-fire safe shutdown analysis for Susquehanna Steam Electric Station (SSES), information contained in NRC Information Notice (IN) 84-09 was used to identify the systems and components required for safe shutdown. Specifically, Section V. of IN 84-09 was used for this purpose. Section V. of IN 84-09 states:

> "The systems and equipment needed for post-fire safe shutdown are those systems necessary to perform the shutdown functions defined in Section III.L of Appendix R. These functions are reactivity control, reactor coolant make up, reactor heat removal, process monitoring, and associated support functions. The acceptance criterion for systems performing these functions is also defined in Section III.L:
>
> During post-fire shutdown, the reactor coolant system process variables shall be maintained within those predicted for a loss of normal a.c. power, and the fission product boundary integrity shall not be affected; i.e. there shall be no fuel clad damage, rupture of any primary coolant boundary, or rupture of the containment boundary."

Since the SSES Safe Shutdown Methodology used the automatic depressurization system (ADS) for pressure control along with the core spray system (CS) for reactor coolant make-up in support of Appendix R Safe Shutdown and since the use of ADS would result in the reactor system process variables being worse than those predicted for a loss of normal a.c. power, Deviation Request No. 33, Reactor Coolant Make-up and Depressurization Systems, was prepared and submitted for NRC acceptance. This deviation was, subsequently accepted by the NRC in a Safety Evaluation dated August 9, 1989. In the technical evaluation performed by the NRC's contractor, the contractor's basis for acceptance of this deviation was that "...the performance criteria as defined in Appendix R are all met. ...the level of coolant will always be above the top of the core." Therefore, the use of ADS and CS is an approved shutdown methodology for SSES for satisfying the requirements of Appendix R Section III.G.2, as long as, the reactor coolant level stays above the top of the core. PP&L Calculation EC-THYD-1035 demonstrates that when using ADS and CS for achieving safe shutdown at SSES that the reactor coolant level is always above the top of the core.

From a practical perspective this position makes sense, since ADS and CS is a redundant shutdown path to the use of high pressure systems in that either of these approaches can fully satisfy the performance functions outlined by NRC IN 84-09. In addition, either shutdown approach can satisfy all of the acceptance criteria of NRC IN 84-09 with the exception of the criteria related to process variables which for the ADS and CS approach has been specifically accepted in Deviation Request No. 33 for SSES.

The following additional considerations influenced our decision:

1. This change would require a large number of adjustments in our current licensing basis as described below. Although these items could be accomplished, they would challenge our ability to accomplish some of the other items described in this letter during the same time frame.

   - Changing the shutdown path designation to alternative would require the submittal of addition deviation requests to satisfy the requirements of the second paragraph under Appendix R Section III.G.3.b. Although SSES has extensive sprinkler coverage in most areas, not all areas have complete sprinkler coverage. Those that did not would require NRC acceptance.

   - Changing the shutdown path designation would require revisions to 21 of our currently approved Deviation Requests to obtain approval to deviate from Appendix R Section III.G.3 rather than III.G.2. Numerous changes to our Fire Protection Review Report to modify references would also be required.

2. Finally, the practical difference between considering this shutdown path designation to be redundant, governed by the requirements of Appendix R Section III.G.2, versus alternative, governed by the requirements of Appendix R Sections III.G.3 and III.L, appears to be negligible. The major differences between III.G.2 and III.L are as follows: (1) Under III.L, a loss of offsite power must be assumed. Our III.G.2 shutdown approach, when using ADS and CS, does not credit the availability of offsite power sources; (2) III.G.3 would require a review of our sprinkler and detector arrangements. Based on commitments being made in this letter our sprinkler and detector arrangements are being reviewed; (3) Under III.L.3, procedures for implementing the shutdown are required. Based on commitments being made in this letter, the procedural enhancements recommended by the NRC during the FPFI will be made; (4) A deviation related to reactor process variables being worse than those predicted for a loss of normal a.c. is required. PP&L has processed such a deviation and the NRC has accepted it. The only point of contention is whether the level of the reactor coolant is always maintained above TAF. PP&L has provided technical justification demonstrating that the level of the reactor coolant is always maintained above TAF. Therefore, the technical basis is available to support the NRC acceptance of the deviation.

2. <u>NRC Observation (Report Section F6.1.1)</u>: *"For Paths 1 and 3... During cold shutdown, decay heat removal is achieved by utilizing the normal shutdown cooling mode, with the RHR system injecting directly to and from the reactor pressure vessel and RHRSW cooling the heat exchanger."*

<u>PP&L's Clarification</u>: RHR is not used in the shutdown cooling mode on path 1 and 3. Rather, and as described earlier in the NRC inspection report, CS is used in the alternate shutdown cooling mode on paths 1 and 3. RHR is used in the suppression pool cooling mode on paths 1 and 3 to remove the decay deposited into the suppression pool by CS when it is being used in the alternate shutdown cooling mode.

3. <u>NRC Observation (Report Section F6.2.1)</u>: *"Many of the operator actions specified in Design Change Notice (DCN) 96-0117 (E690), such as verification of valve position, were not found to be integrated into the safe shutdown procedures."*

<u>PP&L's Comment</u>: All of the actions specified in DCN 96-0117 (E690) have been reviewed and it has been verified that each of these actions was included in plant procedures at the time of the NRC FPFI. The actions related to the local manual closing of valve 1/257025 in the Suppression Pool Filter Pump Suction Line is covered by section 4.5.4 of ON-1/200-009. The action to open breaker 18 on panel 1/2Y219 to de-energize SV1/24433 and close air operated valve HV-1/244-F033 is covered in section 4.4 of ON-1/200-009. The action to close

Reactor Recirculation Suction valve HV-243-F023A at MCC 2B237 when operating the plant from the Remote Shutdown Panel is covered by section 3.12.12 of OP-249-002.

3A. NRC Observation (Report Section F6.2.1): *"The licensee agreed with the team's assessment."*

PP&L's Clarification: PP&L did not agree that current procedures do not take into account the impact of fire damage and do not provide guidance regarding the manual operator actions which may have to be performed. As described above in PP&L's response to URI 50-387,388/97-201-04, it is the PP&L's position that the existing procedures, with the exception of those actions itemized in CR 96-3615, adequately include those actions required to support Appendix R Safe Shutdown. PP&L, however, did agree that improvements as itemized in response to Unresolved Item URI 50-387, 388/97-201-04, should be made to improve organization and to better facilitate use of the information available.

4. NRC Observation (Report Section F3.4): *"The team concluded that the local offsite volunteer fire department has limited resources for handling some of the significant fire hazards on site. In addition, the team is concerned with the limited manning of the local offsite fire department and its lack of having sufficient equipment readily committed to a major fire on site. It is the team's opinion that the offsite fire department is limited in capability and that the best way to assure significant fires will be handled efficiently and effectively is to improve onsite manual fire fighting capabilities and response."*

PP&L's Clarification: SSES has agreements with three primary offsite fire companies for fire response and has an agreement with an additional fire company for response of specialized equipment (ladder truck, heavy rescue). The inspection visited only one of the offsite fire companies.

The offsite fire companies are offered training once each year (either at the site or at their fire halls) on the basics of radiation and site access. In addition, PP&L has hosted Pennsylvania State Fire Academy courses for the offsite fire companies at various locations (including the PP&L fire school). These courses are normally hosted once a year as a good neighbor to the community, not as a regular commitment.

The offsite fire companies participate in an annual fire brigade drill. Average response over the past five years has been 25 members from the three offsite fire companies.

Based upon the above, we believe we have adequate offsite support and will continue to work with these fire companies to maintain and improve, where practical, the level of support received.

5. NRC Observation (Report Section F6.3.1.1): *"The team finds that the licensee's disposition related to the removal of stress skin from Thermo-lag panels is not technically sound."*

PP&L's Clarification: The SSES Drawing Change Mechanism PCR 89-5406 that was discussed in this section of the inspection report was not related to the use of Thermo-Lag 330-1 panels for protection on a cable tray. Rather, this PCR dealt with the use of a Thermo-Lag panel as a part of a fire stop assembly used inside the primary protective envelope on the cable tray and resting on top of the actual cables in the tray. Since this portion of the fire stop was in direct contact with the cables inside of the cable tray, the metal stress skin was removed so that it would not pose a damage potential to the cables. We are aware of the importance of stress skin in assuring the structural integrity of the Thermo-Lag 330-1 panels and it was not our practice to remove the stress skin for situations other than the one described above. As we proceed with our Thermo-Lag Resolution efforts, even a fire stop detail such as the one described above, would require a fire test qualification basis prior to it being considered to be a qualified configuration.

September 4, 1998

Mr. Robert G. Byram
Senior Vice President - Generation
and Chief nuclear Officer
Pennsylvania power and Light Company
2 North Ninth Street
Allentown, PA 18101

SUBJECT: NRC SPECIAL INSPECTION REPORT NOS. 50-387 and 50-388/98-09

Dear Mr Byram:

This refers to the inspection conducted on July 29 - 31, 1998, at the Susquehanna Steam Electric Station. The purpose of the inspection was to review the results of the Fire protection Functional Inspection, and your response to the issues raised therein, dated July 20, 1998. The enclosed report presents the results of this inspection.

The results of the inspection were discussed in a telephone conference on August 7, 1998. The additional information your staff provided at that time has been taken into consideration during our deliberations.

Based on the results of this inspection, eight apparent violations were identified and are being considered for enforcement action in accordance with the "General Statement of Policy and Procedure for NRC Enforcement Actions" (Enforcement Policy), NUREG-1600. We have found deficiencies in your fire protection program relating to control of combustible materials, physical examinations for fire brigade members, availability of piping system keepfill in the post-fire environment, ability of your safe shutdown methodology to achieve the safe shutdown goals described in Appendix R to 10CFR50, design and installation of the fire detection and suppression systems at the site, and emergency lighting provided to perform post-fire shutdown actions. We note that your positions with regard to these matters are delineated in your letter of July 20, 1998.

In addition, please be advised that the number and characterization of apparent violations described in the enclosed inspection report may change as a result of further NRC review. You will be advised by separate correspondence of the results of our deliberations on this matter.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter, its enclosure will be placed in the NRC Public Document Room (PDR).

Sincerely,

ORIGINAL SIGNED BY:

William H. Ruland, Chief
Electrical Engineering Branch
Division of Reactor Safety

Docket No. 50-387, 50-388
License No. NPF-14, NPF-22

Enclosure: Inspection Report 50-387 and 50-388/98-09

cc w/encl:
R. F. Saunders, Vice President - Site Operations
G. T. Jones, Vice President - Engineering and Support
G. Kuczynski, General Manager - SSES
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G. D. Miller, General Manager - Nuclear Engineering
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H. D. Woodeshick, Special Assistant to the President
J. C. Tilton, III, Allegheny Electric Cooperative, Inc.
Commonwealth of Pennsylvania

U.S. NUCLEAR REGULATORY COMMISSION

REGION I

Docket Nos:	50-387, 50-388
License Nos:	NPF-14, NPF-22
Report Nos.:	50-387/98-09, 50-388/98-09
Licensee:	Pennsylvania Power and Light Company
Facility:	Susquehanna Steam Electric Station
Location:	Salem Township, Luzerne County, Pennsylvania
Dates:	July 29 - August 7, 1998
Inspectors:	Roy L. Fuhrmeister, Sr. Reactor Engineer
Approved by:	William H. Ruland, Chief Electrical Engineering Branch Division of Reactor Safety Region I

Table Of Contents

Executive Summary

This inspection was conducted as a followup to the Fire Protection Functional Inspection (FPFI) performed during October and November 1997, and documented in NRC Inspection Report 50-387 and 50-388/97-201. The purpose of this inspection was to review the unresolved issues from the FPFI inspection to characterize the findings for appropriate enforcement actions. The inspection included review of the Pennsylvania Power and Light (PP&L) letter dated July 20, 1998, which responded to the issues raised in the FPFI Report, independent verification of information provided in the July 20, 1998, letter, and tours of selected areas of the plant.

Plant Support

- The failure to properly implement controls of combustible material and transient equipment in the ESSW Pumphouse is an apparent violation. (EEI 50-387&388/98-09-01) (Section F8.1)
- The failure to perform annual physical examinations for fire brigade members, as required by NDAP-QA-0445 is an apparent violation. (EEI 50-387&388/98-09-02) (Section F8.3)
- The failure to provide the necessary tools and materials to make the connection from the fire water system to the CTS for keepfill, as described in the post-fire safe shutdown analysis, is an apparent violation. (EEI 50-387&388/98-09-03)
- The failure of the ADS/CS shutdown methodology to meet the safe shutdown performance goals specified in 10 CFR 50, Appendix R, Section III.L is an apparent violation. (EEI 50-387&388/98-09-04)(Section F8.5)
- This failure to properly implement the requirements of NFPA 72E in the design and installation of the fire detection system is an apparent violation. (EEI 50-387&388/98-09-05)(Section F8.7)
- The failure to properly implement the requirements of NFPA 13 in the design and installation of the sprinkler systems is an apparent violation. (EEI 50-387&388/98-09-06) (Section F8.7)
- The failure to properly implement the requirements of NFPA 14 in the design and installation of the standpipe and hose reel system was considered a non-cited violation as a result of being identified by PP&L. (NCV 50-387&388/98-09-07) (Section F8.7)
- The failure to provide emergency lighting an all areas requiring manual actions to achieve safe shutdown is an apparent violation. (EEI 50-387&388/98-09-08) (Section F8.9)

Report Details

This inspection was conducted as a followup to the *Fire Protection Functional Inspection* (FPFI) performed during October and November 1997, and documented in NRC Inspection Report 50-387 and 50-388/97-201. The purpose of this inspection was to review the unresolved issues from the FPFI inspection to characterize the findings for appropriate enforcement actions. The inspection included review of the Pennsylvania Power and Light (PP&L) letter dated July 20, 1998, which responded to the issues raised in the FPFI Report, independent verification of information provided in the July 20, 1998, letter, and tours of selected areas of the plant.

IV. Plant Support

F8 Miscellaneous Fire Protection Issues

F8.1 (Closed) URI 50-387&388/97-201-01: Failure to follow plant administrative controls in the essential safeguards service water (ESSW) pumphouse. Combustible material in excess of five pounds was stored in the transient material area at the east end of the pump house. In addition, a portable stairway was chained to a spare conduit without approval from engineering.

These deficiencies were corrected prior to the end of the FPFI by removal of the combustible material and chaining the portable stairway to nearby structural steel. PP&L personnel performed additional walkdowns of the facility and found no similar problems. Subsequent actions by PP&L included prohibiting the use of small plastic vacuum cleaners in the plant.

The inspector conducted tours of the facility to confirm the effectiveness of the corrective actions. No additional deficiencies were identified.

The Fire Protection Review Report (FPRR), Table 5.0-1, Section B.2.c states that administrative controls at Susquehanna Steam Electric Station (SSES) govern the handling of, and limit, transient fire loads. Procedure NDAP-QA-0440 implements these administrative controls. In addition, procedure NDAP-QA-0552 governs the handling of transient equipment in the plant.

The failure to properly implement the requirements of NDAP-QA-0440, Rev. 2, Control of Transient Combustible/Hazardous Material," and NDAP-QA-0552, Rev.1, "Transient Equipment Controls," in the ESSW Pumphouse appears to be a violation of the license condition. (EEI 50-387&388/98-09-01)

F8.2 (Closed) Program Weakness: Fire brigade effectiveness to control and extinguish a flammable/combustible liquids fire impacted by the policy to restrict the use of fire fighting foam on site. Amendment 27 to the Final Safety Analysis Report (FSAR) excludes the installation of fire protection foam anywhere in the plant.

In its response letter dated July 20, 1998, PP&L stated that all of the flammable liquids hazards would be three-dimensional or pressure fires, not pool type fires with a horizontal surface. It further stated that, since the turbine generator lubricating oil system, hydrogen seal oil system and transformers have pre-action or deluge sprinkler systems, the use of manual fire fighting foam is not appropriate. This is due to the discharge of the sprinkler system breaking up the foam blanket and rendering it ineffective.

The inspector reviewed the April 1981 Safety Evaluation Report (SER) for the SSES. Amendment 7 to the FSAR added leak proof metal covers to the new fuel storage vault, and Amendment 27 prohibited installation of fire fighting foam systems anywhere on the site. SER Section 9.1.1, New Fuel Storage, states "We agree with the applicants that the addition of the metal covers and the absence of fire fighting foam systems would be an acceptable alternative to performing k_{eff} calculations assuming optimum moderation." The policy to restrict fire fighting foam is in conformance to the facility's licensing basis.
This matter is resolved and closed.

F8.3 (Closed) Program Weakness: Failure to meet NDAP-QA-0445 procedural requirements for annual physicals for fire brigade members. Operations Department had changed over to biennial physicals for fire brigade members in 1995. The entire operations fire brigade complement received their first biennial physical in 1996.

The July 20, 1998, response to the FPFI report states that the operations department procedures NDAP-QA-0625 and 0653 have been revised to require annual physicals for fire brigade members. It further states that, with the exception of five operations personnel scheduled for October 1998, all fire brigade members have had their annual physicals. The annual cycle for physicals will be restored by the end of 1998.

The revisions brings the operations procedures into compliance with NDAP-QA-0445, Rev. 2, "Fire Brigade." The completion of the physical exams in October, 1998 will bring all members of the fire brigade into compliance with the requirements.

The failure to perform annual physical examinations for fire brigade members, as required by NDAP-QA-0445 appears to be a violation of the license condition. (EEI 50-387&388/98-09-02)

F8.4 (Closed) URI 50-387&388/97-201-02: Post-fire safe shutdown methodology does not assure availability of keep-fill system to prevent water hammer in the high pressure coolant injection (HPCI), reactor core isolation cooling (RCIC), core spray (CSS), and residual heat removal (RHR) system discharge piping. The condensate transfer system (CTS) and the cross-tie to the demineralized water system alternative keepfill scheme are not powered from a 1E bus, which would make them unavailable during a fire which causes a loss of offsite power (LOOP). PP&L had previously developed an alternate keepfill scheme using a temporary hose to supply water from the fire water system to the CTS. During a walkthrough conducted by the FPFI team, the tools and equipment necessary to make the connection were not available.

The July 20, 1998, PP&L response states that the tools and equipment necessary to make the connection from the fire water system to CTS were staged November 26, 1997. The response fur r states that the time lines documented in calculation EC-013-0843 show the systems being initiated within the first 40 minutes after a fire in most cases, which indicates that the loss of keepfill would not adversely affect the ability of the systems to perform their safe shutdown functions. This conclusion is born out by testing conducted subsequent to the FPFI which showed that the discharge piping pressure was maintained in the CSS for over 24 hours.

The inspector reviewed the timelines documented in calculation EC-013-0843, Rev. 5, "SSES 10CFR50 Appendix R Compliance Manual," and verified the starting times of the systems in the analyses. In addition, the inspector inventoried the equipment and tools staged for making the fire water to CTS cross-tie and determined that appropriate connectors, hose, check valves and tools were provided.

The failure to provide the necessary tools and materials to make the connection from the fire water system to the CTS for keepfill, as described in the post-fire safe shutdown analysis, appears to be a violation of the license condition, since Section 1.2 of the FPRR commits to Section III.G of Appendix R to 10 CFR Part 50, and Section 5.1.1 of the attachment to Generic Letter 86-10 states that the performance goals of Section III.L of Appendix R also apply to the remote and alternative shutdown capabilities specified in Section III.G.3 of Appendix R. (EEI 50-387&388/98-09-03)

F8.5 *(Closed) URI 50-387&388/97-201-03*: Failure of the automatic depressurization system/core spray (ADS/CS) post-fire safe shutdown methodology to meet the performance goal of maintaining the reactor water level above the top of active fuel (TAF). Calculation EC-013-0843 showed that spurious safety relief valve (SRV) opening could cause reactor water level to drop below TAF. Further, calculation EC-013-0509, Rev. 1, "Minimum Reactor Water Level Under Spurious SRV Operation During a Control Room Fire," showed that spurious opening of one or two SRVs could cause reactor water level to go below TAF.

Deviation Request #33 in the SSES FPRR states "... the reactor coolant makeup function will be capable of maintaining the reactor coolant level above the top of the core." The deviation request was to allow use of the ADS/CS shutdown methodology in lieu of high pressure injection systems. The FPRR was approved, as documented in an NRC SER dated August 9, 1989.

The July 20, 1998, PP&L response to the FPFI report indicates that a revision to a thermal-hydraulic calculation, EC-THYD-1035, was performed to evaluate the coolant level inside the core shroud for the ADS/CS safe shutdown methodology. This analysis did not specifically model the case of spurious actuations of SRVs since that scenario would start the reactor depressurization at a lower pressure, reducing the time necessary to inject using the low pressure system. PP&L concluded that the two-phase steam and water mixture inside the core shroud, with a maximum void coefficient of approximately 0.8 (void fraction at core exit is approximately 0.7 at normal full power conditions) would remain above TAF.

The inspector reviewed EC-THYD-1035, Rev. 1, "In-Shroud Level Response for a Boildown Transient with ADS at TAF," to evaluate the results of the ADS/CS analysis. Assuming that ADS actuates automatically at the appropriate setpoint, the calculation shows that reactor coolant level drops to 52 inches below TAF, with partial core uncovery for a period of about 5 minutes. If ADS actuation is delayed until the manual action in the emergency operating procedures (EOPs), minimum level reaches 84 inches below TAF. The inspector also reviewed calculation EC-013-0509, Rev. 1, "Minimum Reactor Vessel Water level Under Spurious SRV Operation During a Control Room Fire," to evaluate the vessel level response in the case of spurious actuation of SRVs caused by hot shorts. EC-013-0509 determined that for the case of one or two SRVs opening due to fire damage, partial core uncovery can occur for periods of up to one and one half hours if no operator action is taken.

The failure of the ADS/CS shutdown methodology to meet the safe shutdown performance goals specified in 10 CFR 50, Appendix R, Section III.L appears to be a violation of the license condition, since Section 1.2 of the FPRR commits to Section III.G of Appendix R, and Section 5.1.1 of Enclosure 1 to Generic Letter 86-10 states that the performance goals of Section III.L of Appendix R apply to remote and alternative shutdown methods under Section III.G.3 of Appendix R. (EEI 50-387&388/98-09-04)

F8.6 _(Closed) URI 50-387&388/97-201-04:_ Failure to identify preferred post-fire safe shutdown instrumentation and required post-fire safe shutdown actions in procedures used for post-fire safe shutdown from inside the control room.

In the event of a fire in the plant, the operators use emergency operating procedures (EOPs), off-normal (ON) procedures, operating procedures (OPs), and pre-fire plans for guidance on actions to be taken and equipment which is available. The ON for fire conditions is ON-013-001, "Post-Fire Shutdown Procedure."

The inspector reviewed Revision 8 to ON-013-001 to determine what information it provided operators for post-fire conditions. The attachments provide specific guidance for actions to compensate for fires in different areas of the facility, as well as a listing of locations of sound-powered telephone stations for establishing communication. The pre-fire plans for the various fire areas list the equipment and instrumentation which may be affected by a fire in that area.

Based on the fire affected instrumentation being identified in the pre-fire plans, and the required actions being identified in the attachments to the off-normal procedure, there is no violation of requirements. This issue is closed.

F8.7 _(Closed) URI 50-387&388/97-201-05:_ Fire mitigation system design and installation does not appear to meet minimum industry codes and standards. Smoke detector locations do not take into consideration all aspects of ceiling shape and surface, ceiling height, and the effects of the ventilation system, as required by National Fire protection Association (NFPA) Standard 72E. Sprinkler installations do not conform to the requirements of NFPA 13. Hose reel and standpipe locations do not conform to the requirements of NFPA 14. These deficiencies were identified by FPFI team members who performed a walkdown of several elevations in the Unit 1 and Unit 2 Reactor Buildings, with the exception of the hose reel and standpipe locations.

The code of record for the fire and smoke detection system is the 1975 edition of NFPA 72D, "Standard for the Installation, Maintenance and Use of Proprietary Signaling Systems for Watchmen, Fire Alarm and Supervisory Service." The associated standard for fire and smoke detector placement is the 1974 edition of NFPA 72E, "Standard on Automatic Fire Detectors." During tours of the facility, the FPFI inspection identified the following deficiencies with smoke and heat detector placement:

- On the 670'-0" level of the Unit 1 Reactor Building, the FPFI team identified two detectors (1-I-222 and 1-I-219) which were suspended more than one foot below the ceiling. This is contrary to NFPA 72E Section 4-3, which requires that spot type smoke detectors be mounted on the ceiling.

- On the 719'-0" level of the Unit 2 Reactor Building, the team found smoke detectors in rooms 406 and 407 which were mounted within one foot of the supply air diffuser, with the air flow directed across the detector. This is contrary to NFPA 72E, Section 4-4, which prohibits placing smoke detectors where air from supply diffusers could dilute smoke before it reaches the detector.

This failure to properly implement the requirements of NFPA 72E in the design and installation of the fire detection system appears to be a violation of the license condition. (EEI 50-387&388/98-09-05)

FPRR Sections 4.2, "Automatic Wet pipe Sprinkler Systems," 4.3, "Dry Pipe Sprinkler Systems," and Table 5.0-1, Section E.3.c state that the sprinkler systems were designed in accordance with NFPA Standard 13. The code of record for the sprinkler systems is the 1974 edition of NFPA 13, "Standard for the Installation of Sprinkler Systems." Additional guidance on sprinkler system design and installation is contained in NRC Generic Letter (GL) 86-10, "Implementation of Fire Protection Requirements." During facility tours, the inspection team identified the following deficiencies regarding sprinkler installation:

- The upright sprinkler head located outside door 1-109 (Unit 1 remote shutdown panel room) has the sprinkler head and deflector located at a 45 degree angle, and appears to have fire barrier material on its fusible link and deflector. This is contrary to NFPA 13 Section 4-2.4.7 which requires sprinkler deflectors to be parallel to roofs and ceilings, and NFPA 13 Section 3-16 which prohibits application of coatings to sprinklers after they leave the place of manufacture.

- An upright sprinkler head located above the Unit 1 HPCI pump is connected to a ½"X4" pipe nipple, and is located in a beam pocket such that the spray pattern is obstructed on all sides. This is contrary to NFPA 13 Section 4-2.4 which requires sprinklers in bays to be at sufficient distances from beams to avoid obstruction of sprinkler discharge pattern, and NFPA 13 Section 7-1, which prohibits the use of ferrous piping less than one inch nominal size.

- There are obstructions below the sprinkler heads outside the door to the Unit 2 traversing incore probe room (door 406 on the 719'-0" level of the Unit 2 Reactor Building) including light fixtures, beams and electrical boxes. This is contrary to NFPA 13 Chapter 4 which requires minimizing the interference to discharge patterns from beams, braces, girders, trusses, lighting fixtures, and air conditioning ducts.

- The control rod drive pump area on the 719'-0" level of the Unit 2 Reactor Building has overhead obstructions, including lighting fixtures, beams, and electrical components that inhibit the sprinkler from developing and delivering an effective spray pattern to the floor within the protected area. This is contrary to NFPA 13, Chapter 4.

- On the 749'-0" level of the Unit 2 reactor building, near column-line T30.5, the ceiling level sprinklers are obstructed by a four feet wide ventilation duct and by Thermo-Lag barrier E2KK21, which is also greater than four feet wide. This is contrary to NFPA 13 Chapter 4.

The failure to properly implement the requirements of NFPA 13 in the design and installation of the sprinkler systems appears to be a violation of the license conditions. (EEI 50-387&388/98-09-06)

FPRR Section 4.6 and Table 5.0-1 Section E.3.d state that NFPA 14 was used as guidance for the design and installation of the system of standpipes and hose reels in the station. The code of record is the 1974 edition of NFPA 14, "Standard for the Installation of Standpipe and Hose Systems." SSES uses a Class II system. consisting of 1-1/2" hoses intended for use by the building occupants until the arrival of the fire department. Section 3-2.2 requires that the location and spacing of the hose stations be such that all portions of each story of the building are within 30 feet of a nozzle when attached to not more than 100 feet of hose. The FPFI team examined several hose stations serving the main control room and the Unit 1 lower cable spreading room. No deficiencies were identified. During the week of October 27, 1997 (while the FPFI team was off-site), PP&L performed additional walkdowns, and identified several hose stations which did not meet the area coverage requirement. These deficiencies were documented in condition report 97-3650. This non-repetitive licensee-identified violation, with committed corrective actions, of the fire protection license condition—ultimately NFPA 14—is being treated as a Non-Cited Violation, consistent with Section VII.B.1 of the NRC Enforcement Policy. (NCV 50-387&388/98-09-07)

In its July 20, 1998, letter, PP&L stated they are performing a comprehensive assessment of the fire detection and suppression systems for safety related areas of the facility. This assessment will include walkdowns of the in-plant installation to determine the level of compliance of the installed systems. Deviations from the requirements will be justified based on additional analyses, or entered in to the corrective action program. Corrections will implemented under the plant modification process. PP&L expects to complete the walkdowns and evaluations by the end of 1998.

F8.8 (Closed) URI 50-387&388/97-201-06: Operational suppression capability of the CO_2 systems has never been demonstrated by code-required system full discharge tests. The only CO_2 total flooding system at SSES which was full discharge tested failed the test. No additional full discharge tests were performed, and an alternative testing methodology was used.

FPRR Section 4.8, and Table 5.0-1, Section E.5 state that the carbon dioxide fire suppression systems are designed in accordance with NFPA 12. The code of record for the carbon dioxide systems is the 1973 edition of NFPA 12, "Standard on Carbon Dioxide Extinguishing Systems." In addition, Table 5.0-1, Section A.2 states, "Appropriate procurement and drawing procedures existed in Bechtel for the control of inspections, tests, and instructions for the fire protection equipment and systems during the procurement and construction phases."

Total flooding gaseous suppression systems are installed in cable chases, relay rooms, control room under floor areas, control room soffit areas, and rooms C-411, C-412, C-413, and C-414 soffit areas. These systems were designed and installed under Bechtel Specification 8856-M-344. Section 10.3 of the specification states, "A full carbon dioxide discharge test and concentration test shall be made for each hazard." The only total flooding CO_2 suppression system to be full discharge tested at SSES, the elevation 698' north cable chase, failed the test, due to inadequate agent retention time. The test results are documented on work authorization (WA) U27611. The WA does not contain any data in the "CO_2 Concentration %" column. Strip chart traces attached to the WA indicate that the longest time the agent was maintained at 50% concentration was 13 minutes at one foot from the floor elevation. The test results were not signed for acceptance by the Factory Mutual witness, as required. In a Mutual Atomic Energy Reinsurance Pool (MAERP) reinspection report dated April 23, 1982, the test was accepted on the basis that the retention time was expected to have been met had the access door not been left open. The report concluded, "In the future during testing, carbon dioxide concentration levels will be monitored for a minimum of twenty minutes to permit a more complete evaluation of how well the extinguishing agent is holding." The "future" tests were never conducted. NRC Inspection report 50-387&388/89-09 documented that initial acceptance tests of the other systems were not performed.

To resolve the 1989 open item, PP&L proposed alternate testing to verify the capability of the carbon dioxide total flooding suppression systems to maintain the required concentration for the required time to ensure complete extinguishment. This test methodology is based on the alternate testing described in the 1989 edition of NFPA 12A, "Standard on Halogenated Fire Extinguishing Agent Systems - Halon 1301." This alternate test methodology was reviewed and approved by the Office of Nuclear Reactor Regulation (NRR) in an SER dated May 12, 1992. That SER refers to the failed full discharge test documented on WA-U27611, and the fact that no other preoperational testing was performed to demonstrate the systems' capabilities. Thus, it can be shown that NRR was aware of the test failure, and the reasons to which it was attributed, at the time they reviewed and approved the alternate test methodology.

Based on the SER specifically recognizing that the only full discharge test attempted at SSES failed, and approving the alternate testing, this matter is resolved and closed.

F8.9 (Closed) URI 50-387&388/97-201-07: Failure to provide the required post-fire safe shutdown lighting in areas, and have a program that assures the operability of required lighting in the "E" diesel building. During a walkthrough of the procedure for shutdown outside the control room, the FPFI team identified several areas of the plant where manual actuations were required to be performed that did not have the required 8-hour battery supplied emergency lights. In addition, the team found that the emergency lights in the "E" diesel generator building, where manual actions would need to be performed in the event the "E" diesel generator were aligned in place of one of the divisional diesel generators, had not been evaluated to determine which were needed for safe shutdown.

FPRR Section 3.3.2 and Table 5.0-1, Section D.5.a, state that SSES will conform to the emergency lighting requirements in Section III.J of Appendix R to 10 CFR, Part 50. Section III.J requires that emergency lighting units (ELUs) with at least an 8-hour battery power supply be provided an all areas needed for operation of safe shutdown equipment, and in access and egress areas thereto.

The FPFI team conducted a walkthrough of the Unit 1 alternate shutdown procedure, ON-100-109. During that walkthrough, the following emergency lighting deficiencies were identified:

- The procedure required reactor water cleanup (RWCU) system equipment located in a corridor on the west side of the 779'-0" level of the reactor building to be checked for evidence of leakage or flow diversion. There are no safe shutdown emergency lights in this area.

- The procedure requires that breaker #18 in power panel 1Y219 be opened to stop RWCU leakage, or flow diversion to radioactive waste or the main condenser via RWCU. Power panel 1Y219, located on the 719'-0" level of the Unit 1 reactor building is not illuminated by an ELU.

- To ensure that shutdown cooling return flow is injected into the reactor vessel, rather than the recirculation loop, flow control valve HV-243-FO23A must be closed. Since this valve can not be controlled from the remote shutdown panel, for shutdown outside the control room, actions must be carried out at motor control center (MCC) 2B237043. No emergency lighting was installed at the MCC.

The FPFI team also evaluated emergency lighting in other areas of the plant. In the event that the "E" diesel generator is aligned in place of one of the divisional diesel generators, manual actions will need to be carried out in the "E" diesel generator building for shutdown outside the control room. No safe shutdown lights had been provided in the "E" diesel generator building.

In their July 20, 1998, response, PP&L stated that the RWCU actions were not needed to reach hot shutdown conditions. This statement is supported by a revision to calculation EC-013-0859, "Appendix R Analysis for a Control Room Fire." Revision 7 to the calculation, dated June 24, 1998, documents that there are more than eight hours after the fire, in which to isolate the RWCU system. This calculation revision also shows that RWCU isolation is not needed to achieve hot shutdown conditions. As a result, PP&L is removing the RWCU isolation actions from the alternate shutdown procedures.

PP&L has identified those ELUs in the "E" diesel generator building necessary for post-fire safe shutdown. Those ELUs have been added to the maintenance and surveillance testing programs.

The failure to provide emergency lighting in all areas requiring manual actions to achieve safe shutdown appears to be a violation of the requirements of Section III.J of Appendix R to 10 CFR 50, as committed to in Section 1.2 of the FPRR, and therefore an apparent violation of the license condition. (EEI 50-387&388/98-09-08)

V. Management Meetings

X1 Exit Meeting Summary

An exit meeting was conducted by telephone on August 7, 1998. At that time, PP&L acknowledged the inspection findings and provided additional information regarding the time frame for corrective actions. The inspector was also informed that several of the issues are being pursued generically by the Boiling Water Reactor Owners Group.

None of the information reviewed during the course of the inspection was identified as proprietary.

PARTIAL LISTING OF PERSONNEL CONTACTED

Pennsylvania Power and Light

G. Miller, General Manager, Nuclear Engineering
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M. Simpson, Manager, Nuclear Technology
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R. Wahry, Supervising Engineer, licensing
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W. Williams, Senior Engineer, Licensing

Nuclear Regulatory Commission

J. Richmond, Resident Inspector
A. Blamey, Resident Inspector

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

EEI 50-387&388/98-09-01	Failure to properly implement the requirements of NDAP-QA-0440 and NDAP-QA-0552 in the ESSW Pumphouse
EEI 50-387&388/98-09-02	Failure to perform annual physical examinations for members of the fire brigade
EEI 50-387&388/98-09-03	Failure to provide tools and equipment necessary to make the connection from the fire water system to the condensate transfer system for keepfill
EEI 50-387&388/98-09-04	Failure to meet the safe shutdown performance goal of maintaining reactor vessel level above the top of the active fuel
EEI 50-387&388/09-09-05	Failure to properly implement the requirements of NFPA 72E in the design and installation of the fire detectors
EEI 50-387&388/98-09-06	Failure to properly implement the requirements of NFPA 13 in the design and installation of the fire suppression sprinkler systems.
NCV 50-387&388/98-09-07	Failure to properly implement the requirements of NFPA 14 in the design and installation of standpipe system.
EEI 50-387&388/98-09-08	Failure to provide 8-hour battery powered emergency lighting units in all areas requiring manual actions to achieve safe shutdown

Closed

URI 50-387&388/97-201-01	Failure to follow plant administrative control procedures in the essential safeguards pumphouse
URI 50-387&388/97-202-02	Post-fire safe shutdown methodology does not assure availability of keepfill system to prevent water hammer in the HPCI, RCIC, CSS and RHR system discharge piping
URI 50-387&388/97-201-03	Failure of the ADS/CS post-fire safe shutdown methodology to meet Appendix R reactor performance goals by maintaining the reactor water level above the top of the active fuel

URI 50-387&388/97-201-04	Failure to identify preferred post-fire safe shutdown instrumentation and required post-fire safe shutdown actions in procedures used for post-fire safe shutdown
URI 50-387&388/97-201-05	Fire mitigation system design and installation does not appear to meet minimum industry codes and standards
URI 50-387&3[illegible] 7-201-06	The operational suppression capability of the CO_2 systems has never been demonstrated by code required system full discharge tests
URI 50-387&388/97-201-07	Failure to provide the required post-fire safe shutdown lighting in areas and have a program that assures the operability of required lighting in the "E" diesel building

LIST OF ACRONYMS USED

ADS	Automatic Depressurization System
CFR	Code of Federal Regulations
CSS	Core Spray System
CTS	Condensate Transfer System
ELU	Emergency Lighting Unit
EOP	Emergency operating Procedure
ESSW	Essential Safeguards Service Water
FPFI	Fire Protection Functional Inspection
FPRR	Fire Protection Review Report
FSAR	Final Safety Analysis Report
GL	NRC Generic Letter
HPCI	High Pressure Coolant Injection
k_{eff}	Effective Neutron Multiplication Factor
LOOP	Loss of Offsite Power
NFPA	National Fire Protection Association
NRC	Nuclear Regulatory Commission
MAERP	Mutual Atomic Energy Reinsurance Pool
MCC	Motor Control Center
ON	Off Normal Operating Procedure
OP	Operating Procedure
PP&L	Pennsylvania Power and Light
RCIC	Reactor Core Isolation Cooling
RHR	Residual Heat Removal
RWCU	Reactor Water Cleanup
SER	Safety Evaluation Report
SRV	Safety Relief Valve
SSES	Susquehanna Steam Electric Station
TAF	Top of the Active Fuel
WA	Work Authorization