EXT-91-02763

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

Log No. 3480

May 30, 1991

Docket No. 50-346

Mr. Donald C. Shelton
Vice President, Nuclear - Davis-Besse
Centerior Service Company
Toledo Edison Company
300 Madison Avenue
Toledo, Ohio 43652

RECEIVED
JUN 06 1991
TOLEDO EDISON

Dear Mr. Shelton:

SUBJECT: SAFETY EVALUATION OF FIRE PROTECTION MEASURES AT THE DAVIS-BESSE NUCLEAR POWER STATION, UNIT NO. 1, PER APPENDIX R TO 10 CFR PART 50 (TAC NOS. M60994, M60995, M61745 AND M61923)

Enclosed is a copy of the NRC staff's Safety Evaluation of the Davis-Besse Fire Protection Program. This evaluation summarizes the staff's review of fire protection measures at your facility from July 1983 when the staff conducted an inspection to assess your efforts to comply with the requirements of Appendix R to 10 CFR Part 50, to the present. This review consisted of an evaluation of your numerous submittals as documented in the Safety Evaluation as well as the various revisions of the Compliance Assessment Report (CAR), the Fire Hazards Analysis Report (FHAR) and the Fire Area Optimization Report (FAOR). The information and documentation in these three reports were updated, coalesced and submitted in FHAR, Revision 12, which was submitted on November 8, 1990. The latest report supersedes the reports cited above.

The enclosed Safety Evaluation is complementary to the staff's Inspection Report No. 50-346/90007 issued on August 22, 1990. This inspection report summarizes the results of the Appendix R audit inspections conducted at the Davis-Besse facility in April and May 1990.

Since we are pursuing the issue of potential leakage through reactor coolant pump seals on a generic basis (Generic Issue 23), we consider this issue closed for the purposes of our fire protection review. With regard to the status of fire protection measures in the Davis-Besse Technical Specifications, we find that your commitment to resolve this issue in a forthcoming license amendment is a satisfactory resolution. Finally, we find acceptable your commitments regarding additional fire protection measures to be implemented during the seventh refueling outage in September 1991 and the eighth refueling outage in the spring of 1993.

LL-1

The NRC has no further questions on this implementation of fire protection measures at the Davis-Besse Nuclear Power Station at this time.

Sincerely,

John N. Hannon, Director
Project Directorate III-3
Division of Reactor Projects III/IV/V
Office of Nuclear Reactor Regulation

Enclosure:
As stated

cc: See next page

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO FIRE PROTECTION TO FACILITY OPERATING LICENSE NO. NPF-3

TOLEDO EDISON COMPANY

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

AND

CENTERIOR SERVICE COMPANY

DAVIS-BESSE NUCLEAR POWER STATION, UNIT NO. 1

DOCKET NO. 50-346

I. INTRODUCTION

The staff initial assessment of the Davis-Besse Fire Protection Program is documented in a safety evaluation dated July 26, 1979. Also, in its letters dated June 2 and November 23, 1982 and August 30, 1984, the staff approved a number of exemptions from the technical requirements of Appendix R to 10 CFR Part 50. In July 1983, the staff conducted an inspection to assess the licensee's efforts to comply with the requirements of Appendix R. The inspection revealed that a number of deficiencies existed with respect to meeting certain requirements of the rule. In subsequent meetings with the staff, the licensee committed to implement a plan for corrective action which would attempt to resolve staff concerns regarding the Davis-Besse fire protection program. In the interim, the licensee adopted compensatory actions such as fire watches pending resolution of these issues. The staff evaluated and approved the licensee's interim measures by letter dated September 23, 1983. In its letter dated March 6, 1986, the licensee submitted a revised Fire Hazards Analysis Report (FHAR) which included a new comparison of the Davis-Besse Fire Protection Program with the guidelines contained in Appendix A to Branch Technical Position (BTP) APCSB 9.5-1 (hereafter referred to as Appendix A to the BTP). On the same date, the licensee submitted requests for an exemption from the technical requirements of Appendix R. In its letter dated June 3, 1986, the licensee submitted Revision 1 of the Appendix R Compliance Assessment Report (CAR) and in its letter dated June 25, 1986, the licensee submitted fire test reports to justify the adequacy of fire barrier penetration seals.

The staff reviewed this information and expressed a number of its concerns that the licensee's fire protection program did not conform with NRC fire protection requirements and guidelines. These concerns and requests for additional information (RAI) were transmitted to the licensee in the staff's letter dated December 17, 1986. In its letter dated December 31, 1986, the staff transmitted the results of a preliminary review of the penetration seal fire tests.

The licensee responded to the RAI and provided additional information on the program in its letters dated January 12, February 12, May 14, 22 and 27, and July 30, 1987. A meeting was subsequently held between the staff and licensee on October 29 and 30, 1987, following which the licensee submitted new and supplementary information on its fire protection program in its letters dated January 6, February 8, May 23, June 6, August 9, 1988, January 18, March 15, June 5, July 28, July 31 (two letters), September 30 (two letters), October 11 and 26, 1989. This safety evaluation supplements and amends the previous fire protection safety evaluations.

The licensee submitted further information regarding its fire protection measures and post-fire safe shutdown capability in its letters dated November 22 and December 18, 1989; February 16 and 20, March 22, April 25, and May 10, 1990. These last two submittals documented a revised approach to fire protection measures and post-fire safe shutdown capability at the Davis-Besse facility. Basically, this particular revision documented the coalescing of a number of separate fire areas into larger and/or different fire areas. This coalescing required the staff to reevaluate such items as associated circuits; physical separation of redundant safe shutdown systems; and newly designated fire barriers. This revision is identified as the Fire Area Optimization Program, and was submitted in the Fire Area Optimization Report (FAOR) dated May 10, 1990. The coalescing of some of the previously separate fire areas necessitated the licensee to submit an additional exemption request for the containment annulus from the requirements of Appendix R to 10 CFR Part 50. This additional exemption request, which is pending, was made following meetings with the staff on April 5 and May 9, 1990, and reflects the staff's review of the Fire Area Optimization Program, including two audit inspections at the Davis-Besse plant in April and May 1990 to determine the licensee's compliance with the requirements of Appendix R to 10 CFR Part 50. The results of these cited audit inspections are contained in the NRC Inspection Report No. 50-346/90007, dated August 22, 1990.

Subsequently, the licensee submitted in its letter dated November 8, 1990, another revision to the prior documentation of its fire protection program. This latest revision administratively combined the applicable portions of FHAR, Revision 11 and FAOR, Revision 1, into a single document identified as FHAR, Revision 12. This latter document now contains all the elements and analyses of the Davis-Besse fire protection program. Attachment 1 to the licensee's letter of November 8, 1990 contains a comparison between the licensee's documentation of its fire protection program at the time of the staff's audit inspection in April and May 1990 and that presently contained in FHAR, Revision 12. Since this attachment indicates no technical differences between the two sets of documents, the staff's conclusions and findings in Inspection Report No. 50-346/90007 are unaffected by the submittal of FHAR, Revision 12.

The licensee made a number of commitments in the various letters cited above. Those which were related to the requirements of Appendix R to 10 CFR Part 50 were implemented prior to restart after the sixth refueling outage (i.e., prior to July 1990). Those commitments related to Appendix A to the BTP will be implemented either in the seventh refueling outage starting in September 1991 or during the eighth refueling outage in spring 1993. These latter dates were confirmed in a telephone conference on February 26, 1991.

The licensee's submittal of March 22, 1990 was primarily oriented towards addressing those issues related to the technical specifications regarding fire protection requirements which were added or revised in Amendments 18, 24 and 106 to the Davis-Besse operating license. The licensee has indicated that, pursuant to Generic Letter 86-10, it will propose in the near future a license amendment which will remove those portions of the technical specification related to fire protection. Accordingly, the staff will review the material in the licensee's letter dated March 22, 1990 when the subject license amendment request is submitted. Additionally, those items in the licensee's submittals dated February 16 and February 20, 1990 which were not evaluated in the staff's audit inspection report cited above (i.e., No. 50-346/90007), will be evaluated in a future safety evaluation.

Initially, in describing aspects of the Davis-Besse Fire Protection Program in comparison with NRC fire protection criteria, the licensee specifically indicated where conformance with these criteria was achieved. Where this was not the case, the licensee described its fire protection features and concluded that the existing design conformed with the intent of the criteria. The staff expressed its concern that significant deviations might exist which may not have been adequately justified since there appeared to be insufficient detail to support the licensee's conclusions. Consequently, the licensee provided supplemental information which explicitly identified deviations from staff fire protection guidelines and the relevant National Fire Protection Association (NFPA) Standards and provided justification as to why these deviations were not safety significant. The staff considers these deviations to fall within two categories. The first are those deviations which represent minor variances. These minor variances and those features of the Davis-Besse Fire Protection Program which conform with NRC and NFPA criteria are described comprehensively in the documents cited above and are not discussed in detail in this safety evaluation since the staff finds that the minor deviations are acceptable. The second category are those deviations which are not considered by the staff to be minor variances and for which there was, initially, some concern on the part of the staff regarding the licensees's justification of its technical approach. The staff's basis for accepting these latter deviations is contained in the following evaluation.

II. FIRE PROTECTION SYSTEM DESCRIPTION

Water Supply

The fire protection water supply consists of an electric fire pump which takes suction from a 250,000 gallon tank and a diesel pump which draws water from Lake Erie. The tank is not sized in accordance with Appendix A to the BTP, nor are the two fire protection water supplies directly interconnected. The staff considers the size of the tank to be sufficient because the criteria of Appendix A to the BTP used to determine the required water storage capacity at Davis-Besse assumes 1,000 gallons per minute (gpm) for fire hose streams. However, the actual capability of the licensee's fire

brigade to deliver water during a fire is in the range of 250 to 500 gpm with a five person fire brigade using the 1½ and 2½ inch hoses. Moreover, if additional water greater than the tank capacity is required, an unlimited supply exists from the adjacent lake. Interconnection of the fire protection water supplies is not considered necessary because each pumping system supplying water is sufficiently reliable based on the performance of periodic testing and maintenance and because either pump is capable of satisfying the water demand requirements. The staff therefore, concludes that the fire protection water supply is acceptable even though it deviates from NRC fire protection guidelines.

The staff was concerned that there were locations in the plant where a single pipe break could result in the loss of the water supply to both the automatic sprinkler systems and the standpipe system. The staff's concern was focused on all areas other than the turbine building which has an acceptable design, based on the licensee's description in its letter dated July 30, 1987. In this response, twelve rooms were identified where a single break could result in such an occurrence. However, three of the rooms could still be protected from alternate hose stations which would be unaffected by the break. For the other nine rooms, the licensee committed in its letter cited above to implement design changes to correct the problem. The staff found this approach acceptable based on the licensee's commitment to provide isolation capability. On this basis, the staff concludes that this issue is resolved. The licensee indicated in a telephone conference on February 26, 1991, that the subject design changes for the other nine rooms will be implemented during the eighth refueling outage in the spring of 1993.

The staff also was concerned that above ground fire water supply control valves were not protected against tampering. However, the licensee stated that all such valves are either alarmed in the control room or locked and sealed in the open position. This conforms with the relevant portions of the NFPA standard governing control valve supervision and is, therefore, acceptable.

In its letters dated May 23, 1988 and July 31, 1989, the licensee submitted a comparison of the Davis-Besse Fire Protection Program to the applicable NFPA standards. A number of deviations from these standards indicated in this analysis have been identified for correction. A summary of the proposed modifications in these two letters and the implementing schedules have been reviewed by the staff and found to be acceptable. One of the deviations the licensee identified is the absence of documentation for the water supply system; this documentation would have provided third party approval of certain equipment. However, in light of the continuing serviceability of the water supply since its installation and the cost associated with providing third party documentation for this equipment, the staff does not consider any further effort by the licensee to be justified. The licensee also indicated that certain components did not conform with some of the construction specifications identified in the applicable NFPA Standards. The licensee affirmed in the letters cited above that the construction materials and their performance characteristics are at least equivalent to those that are identified in the pertinent NFPA Standards. On this basis, the staff finds these deviations acceptable.

The staff also expressed its concern that the licensee's NFPA code compliance review for the fire protection water supply did not address certain sections of the relevant NFPA codes. Specific concerns centered on the design details of the electric fire pump controller. The licensee responded that the existing controller will be replaced in a future modification. The licensee identified the NFPA deviation associated with the existing controller in its letter dated October 11, 1989. The licensee justified these deviations in the interim based on periodic surveillance testing. The staff has reviewed the subject deviations and concludes that with the existing surveillance testing, these particular deviations are acceptable. The licensee indicated in a telephone conference on February 26, 1991, that the present controller will be replaced during the seventh refueling outage in the fall of 1991 and will confirm when these measures are implemented.

Automatic Sprinkler Systems

In its comparison of the Davis-Besse fire protection program with Appendix A to the BTP, the licensee identified deviations related to sprinkler and water spray system conformance with the criteria contained in NFPA Standard Nos. 13 and 15. Deviations were identified which were associated with design and acceptance test criteria and other guidance for certain system components. An example is the lack of identification signs on valves not directly related to system performance. The staff reviewed the licensee's justification for these deviations and agrees with the licensee that they lack significance in that the plant personnel are trained to recognize the valve number identification.

The licensee also identified a number of deviations pertaining to the positioning of sprinkler heads and water spray nozzles in relation to structural elements and other plant features which could represent obstructions to the discharge of water from the sprinkler systems. Other deviations were noted such as improper sprinkler type, temperature rating, and inadvertently painted sprinkler heads. As delineated in its letters dated May 23, 1988 and July 31, 1989, the licensee has committed to correct most of these conditions so that the final configuration will be in conformance with the subject NFPA Standards. The staff has reviewed the deviations which will not be corrected, along with the licensee's justification for not doing so, and agrees that the subject deviation represents an acceptable level of protection based on such factors as the limited combustible loading in the affected areas. The licensee indicated in a telephone conference on February 26, 1991, that it will make those corrections required to be in compliance with Appendix A to the BTP during the eighth refueling outage in the spring of 1993. Those changes required to be in compliance with Appendix R to 10 CFR Part 50 have been completed. During its review of the licensee's NFPA Code conformance comparison, the staff requested justification as to why several criteria were judged by the licensee to be not applicable to Davis-Besse. The licensee provided a satisfactory response to these questions in its letter dated October 11, 1989. The staff also requested that the licensee provide justification that a proposed modification, delineated in the NFPA code comparison, would conform with the criteria in Section 2-1.2 of NFPA Standard No. 15. The

licensee stated in the letter cited above that the modification, which involves adding batteries with a charging system to the fire water spray release control system, will be in accordance with the relevant sections of NFPA 15. The licensee indicated in a telephone conference on February 26, 1991, that this commitment has been implemented.

Standpipe and Hose System

As part of its comparison of the design of the standpipe and hose system to NRC fire protection guidelines and the criteria contained in NFPA Standard No. 14, the licensee identified several deviations in its letters dated January 6, 1988 and July 31, 1989. Several of these deviations pertain to the use of unlisted equipment, use of materials which do not meet the construction specifications of this standard, and the nature of the acceptance testing. The staff reviewed these deviations, including the licensee's justification and concludes that these conditions will not adversely affect system performance and are, therefore, acceptable based on the continuing acceptable performance of these system.

A number of deviations were identified related to the size of piping and system pressure and flow characteristics which result in certain locations where standpipe outlets are not able to deliver the quantity of water at sufficient pressure as required by the applicable NFPA Standard. As stated above in our evaluation of the plant water supply, the staff finds that the NFPA Code requirements for water for manual fire fighting are conservative in light of the fact that the smaller piping at the Davis-Besse plant can deliver at least 250 gpm per outlet. This is equivalent to flow from two 1½ inch hose lines or one 2½ inch hose line. The staff concludes that this capability is sufficient to suppress potential fires in the subject areas based on the limited combustible loadings in these areas.

Another deviation pertains to the lack of pressure reducing devices at standpipe outlets where the system pressure exceeds 100 psi. Because warning signs are posted at these locations and the fire brigade is trained to operate hoses at the higher pressure, the staff concludes that this condition is acceptable.

The staff also expressed concern that an insufficient quantity of hose existed to reach all areas of the service water/turbine building tunnel. The licensee responded in its letter dated October 11, 1989 that additional lengths of hose are available to reach the most remote areas of the tunnel and the location of extra hose is described in the Davis-Besse pre-fire plans which describe the fire brigade's response to a fire in this area. Because of the availability of the hose and the fire brigade training, the staff finds this to be acceptable.

Fire Detection and Alarm System

The staff requested information from the licensee regarding the design of the fire detection, alarm and signaling system with respect to the criteria contained in NFPA Standard Nos. 72D and 72E. This information was provided by the licensee in its letters dated May 27, 1987; May 23, 1988; July 31 and October 11, 1989. The licensee identified a number of deviations from these standards and committed to correct a number of them. The remainder represent conditions which the licensee has determined are not safety

significant. Several deviations pertain to the nature of acceptance testing, the use of unlisted equipment, and the distinctiveness of alarms.

The staff has evaluated these deviations and the licensee's justification and concludes that the Davis-Besse fire protection measures assures a level of protection equivalent to that achieved by strict conformance with the NFPA Codes. On this basis, we find these subject deviations acceptable.

The licensee identified several locations where the position of fire detectors is not in accordance with the applicable NFPA Code. The staff finds, however, that these conditions would, at most, result in a relatively minor time delay in receipt of an alarm. The staff, therefore, considers these conditions to be acceptable.

The licensee also noted deviations associated with the detectors installed in conjunction with the pre-action type sprinkler systems in the turbine building and turbine building heater bay. In lieu of correcting the detector deviations, the licensee proposed to convert the existing pre-action systems into conventional wet-pipe sprinkler system including removal of the pre-action detectors in the system as described in its letter dated May 23, 1988. The licensee indicated in a telephone conference on February 26, 1991, that it had converted the subject pre-action systems as proposed. The staff has evaluated this matter and concludes that the licensee's design provides an equivalent level of safety and is, therefore, acceptable.

The licensee has concluded that the power supply for the fire detection, alarm and signaling systems complies with the intent of the NFPA Codes without performing an explicit analysis using the criteria of the standards. The staff expressed its concerns about the reliability of the power supply. In response, the licensee noted that these systems are powered from multiple redundant sources (e.g., off-site power, main generator output and batteries) of the in-plant electrical system. Since these redundant sources supply power to safety-related equipment and systems which have been previously reviewed and approved by the staff, no further evaluation of conformance with NFPA criteria is necessary. On this basis, we find that the power supply for the fire detection, alarm and signaling systems are acceptable.

During its review of the licensee's fire alarm system, the staff requested clarification regarding visual and audible fire alarms that are transmitted to the control room. The licensee responded in its letter dated May 27, 1987. This information is now provided in Appendix D of Revision 12 to the FHAR. Alarms transmitted via the fire alarm and signaling systems are received both visually and audibly in the control room. Thus, if one type is not functional or observed, the other should assure a proper response by the plant personnel. The licensee noted that, at this time, certain alarms are received in the control room which indicate that a local fire detector panel is in an alarm status. Operators have to go to the panel to determine which fire detector zone alarm has actuated. The licensee committed in the letter cited above to enhance the existing capability by modifying the subject systems to provide critical fire detector zone annunciation in the control room. The licensee indicated in a telephone conference on February 26, 1991, that it will implement this subject commitment during the eighth refueling outage in the spring of 1993. The staff finds the licensee's proposal to be acceptable on the basis that those fire areas requiring prompt response by the fire brigade will be annunicated in the control room.

In its present configuration, alarm conditions from individual detector zones would prevent receipt of subsequent fire or trouble alarms from other operable detection zones controlled by the same panel. If this occurs, the licensee will implement an hourly fire watch patrol to monitor the condition of the affected panel(s). Reliance upon an hourly patrol is required by fire protection procedures for inoperable detectors and is, therefore, acceptable.

The staff expressed its concern that electrical circuits associated with the fire alarm and signaling systems were not supervised in accordance with NFPA Standard No. 72D. The licensee identified a number of deviations from the NFPA Code relating to this issue. At present, a single break or ground fault condition on most circuits will be transmitted as a fire alarm. The licensee will respond to such alarms in accordance with established procedures. Several circuits are unsupervised. The licensee is presently assessing the scope and nature of modifications to correct these deficiencies. The licensee indicated in a telephone conference on February 26, 1991, that these deficiencies will be corrected during the eighth refueling outage in the spring of 1993. Based on the licensee's commitment to respond appropriately to fire alarms, even those caused by spurious signals, and the commitment to correct the cited deficiencies during the eighth refueling outage, we find that this issue is satisfactorily addressed.

III. OTHER ITEMS RELATING TO THE STATION FIRE PROTECTION PROGRAM

Fire Barriers

In the original safety evaluation of the Davis-Besse fire protection program issued in July 1979, the staff accepted the design of fire barriers at Davis-Besse on the basis that all floors, walls and ceilings enclosing separate fire areas are rated at a minimum 3-hour fire rating. Based on the revised post-fire safe shutdown assessment in the Compliance Assessment Report (CAR), which was subsequently contained in the FAQR and is presently contained in Revision 12 of the FHAR, the licensee has re-delineated fire areas in the plant. The staff was concerned that the licensee's Fire Protection Program would not include fire barriers necessary to satisfy the guidelines in Appendix A to the BTP. However, based on the staff's review of the documents cited above, the Davis-Besse Fire Protection Program encompasses these barriers. A related unresolved issue is the licensee's surveillance of the Appendix A barriers under its existing procedures. This issue is addressed in a subsequent section of this evaluation.

The licensee has explicitly identified a number of instances where the fire rating of a structural assembly does not meet the 3-hour criterion. The licensee has also assessed the adequacy of other barriers in accordance with the staff's guidance in Generic Letter 86-10. Fire hazards analyses used to justify these conditions are kept on file by the licensee. The conditions which had not been submitted to the staff for review were reviewed by the staff during its Appendix R audit inspections at the Davis-Besse plant in April and May 1990, in accordance with NRC Generic Letter 86-10. The licensee's analyses of these subject fire barriers were found acceptable.

In its letter dated January 6, 1988, the licensee indicated that some portions of stairwell and elevator shaft walls are 2-hour fire-rated, along with certain walls in non-safety related areas. In addition, the computer

room walls and the kitchen and storage rooms within the control room complex are rated as 1-hour barriers. The staff has evaluated the fire hazards in the areas on either side of the walls as described in the FHAR, Revision 11, and subsequently described in Revision 12 to the FHAR, and concludes that the rating of the walls is sufficient with conservative margin to withstand the effects of a fire until suppressed by the plant fire brigade considering the limited combustible loadings in these areas. The staff concludes, therefore, that these conditions are acceptable.

In the same letter, the licensee identified a number of locations where non-fire-rated heating, ventilation and air-conditioning (HVAC) penetrations exist in the auxiliary building and several other locations. Included with these features were several "blow-out" panels installed for post-accident pressure relief. The licensee's justification for the adequacy of the existing condition included: (1) the presence of automatic sprinkler or water spray systems in the area or at the penetration; (2) the limited combustibles on either side of the barrier; (3) the construction of the HVAC ducts; and (4) the presence of fire doors or dampers. The staff has evaluated these features along with the fire hazards analyses of these locations and concludes that the penetrations cited above will provide an equivalent level of protection to that achieved by 3-hour fire-rated penetrations. On this basis, the staff finds these nonfire-rated penetrations acceptable.

During its review of fire barriers in the plant, the staff requested the licensee to substantiate the fire resistance of the existing cable tray and conduit fire wrap material. The licensee responded in its letter dated May 27, 1987 and committed to replace the existing wrap material with a type that has met all of the acceptance criteria of the standard fire test method of ASTM E-119. The staff Appendix R audit inspections in April and May 1990 confirmed the implementation of this commitment. Replacement encompassed only those cables that are necessary to assure safe shutdown following a fire and are vulnerable to fire damage as delineated in the FHAR, Revision 12. The existing cable wrap material for those cables not necessary to assure safe shutdown may remain in place but will not be maintained. The replacement material was installed during the refueling outage ending in July 1990, in accordance with manufacturer's instructions. Any metal structural elements that are framed into the protected enclosure are protected per the recommendations of the manufacturer of the fire wrap to assure that conductive heat will not damage cables within the enclosure. On this basis, the staff concludes that this issue is resolved.

Fire Doors

In its comparison of the fire protection program with the guidelines in Appendix A to the BTP, the licensee identified a deviation associated with hollow metal-type equipment access doors. The doors are not equipped with closing mechanisms and are not used for personnel passage. When left open for equipment access, a plant procedure will be implemented when required to compensate for the opening, including the posting of either a roving or continuous fire watch, as appropriate. On this basis, the staff concludes that the lack of closing mechanisms on these doors is an acceptable deviation.

During its evaluation of fire doors, the staff expressed concern that security-related modifications may have adversely affected the fire-rating of specific fire doors. The licensee responded to this concern in its letter dated May 27, 1987 in which it stated that it had arranged for certain plant fire doors which are required to satisfy staff fire protection criteria; this was assessed by a representative of Factory Mutual Research Corporation, an independent testing authority. The results of this assessment are contained in a report dated December 19, 1986.

The licensee also compared plant fire doors to the criteria contained in NFPA Standard No. 80. The results of this analysis are contained in its letter dated July 31, 1989. The licensee identified a number of installation variances and committed to correct many of these conditions by making appropriate modifications. Several variances pertain to door hardware and fusible link positioning which the staff has evaluated and concluded are not safety significant. The remaining deviations concern gaps between the edges of the doors and the door frame, wall or floor which exceed the maximum dimensions required in the pertinent NFPA Code. The licensee committed to make repairs on certain doors where the gaps are excessive. For the remaining doors with excessive gaps, the licensee justified the deviations in its letter dated October 11, 1989, on the basis of the results of proprietary fire tests which confirmed that these deviations will not adversely affect the performance of the doors under fire conditions. The staff has reviewed these analyses and test results presented in the letters cited above and concludes that the licensee's technical approach to the subject fire door deviations is acceptable. The licensee indicated in a telephone conference on February 26, 1991, that the modifications to the fire doors, including the gaps cited above, would be implemented during the seventh refueling outage in the fall of 1991.

Fire Dampers

In the licensee's letter dated July 31, 1989, informing the staff of the results of its NFPA code conformance review, the licensee identified a number of deviations associated with fire dampers. One deviation pertained to the absence of fire doors to protect openings in fire walls. However, the licensee has installed fire-rated dampers in lieu of fire doors, with some exceptions, which provide an equivalent level of protection. The lack of dampers at certain HVAC penetrations of fire barriers was discussed previously in this safety evaluation and was found acceptable.

The staff expressed its concern that curtain-type fire dampers, installed in HVAC penetrations of fire barriers, may not perform properly under high airflow conditions. This concern was based on a notification by a damper manufacturer under the requirements of 10 CFR Part 21. The licensee responded to this concern in its letter dated May 27, 1987. All dampers that are relied upon to satisfy staff fire protection criteria have been tested by the manufacturer for the flow conditions encompassing those at the Davis-Besse plant and have been certified as capable of performing under the air flow conditions specified by the licensee. The licensee performed drop tests of the fire dampers under static conditions to verify proper installation and will periodically conduct visual inspections per the plant

procedures. In locations where high air flow conditions exist, the licensee has installed dampers of a type that have not been subject to the concerns expressed in the 10 CFR Part 21 notification cited above. This matter was reviewed during the audit inspections conducted in April and May 1990 and was found to be satisfactorily addressed (Section 3.h of Inspection Report No. 50-346/90007). On this basis, the staff's concerns regarding damper operability are resolved.

Fire Barrier Penetrations

During a regional audit of the fire protection program in 1985, inspectors identified concerns with regard to the adequacy of test documentation which the licensee relied upon to qualify fire barrier penetration seals (refer to Inspection Report No. 50-346/85028). In its letter dated June 25, 1986, the licensee submitted a series of fire test reports to justify the adequacy of penetration seals found in the plant. The staff reviewed the reports and expressed its concern regarding the adequacy of some seals, and also requested clarification on several issues. The results of the staff's initial review and request for information were transmitted to the licensee in the staff's letter dated December 17, 1986. The licensee responded to this letter with a submittal dated February 12, 1987. This submittal included additional test reports which support the licensee's conclusions regarding the adequacy of penetration seals.

The focus of the staff's review was on the following issues:

1. Were the tests conducted in accordance with standard fire test procedures?

2. Were the tests conducted by an independent testing laboratory?

3. Did the results of the tests confirm that the seal assemblies tested meet the guidelines contained in Appendix A to BTP APCSB 9.5-1?

4. Was adequate justification provided where deviations from the above guidelines existed?

5. Were the fire-tested seal assemblies similar to seals found in the plant?

With regard to the last issue, the in-plant configuration was established by the licensee on the basis of typical fire barrier penetration seal details which the staff compared to the tested configuration. The actual in-plant seal configurations were confirmed to be satisfactorily addressed in the April and May 1990 Appendix R audit inspections. (Refer to Section 3.j of Inspection Report No. 50-346/90007.)

For a number of individual seal details, the licensee was able to supply at least one acceptable fire test report per configuration which adequately addressed all issues of concern to the staff. For the remaining seal details, the licensee presented a number of reports which the licensee concluded collectively qualify the fire rating of the seal. The staff

agrees with this approach on the basis that the April 1980 Appendix R audit inspection verified that the in-plant configuration does not significantly deviate from the test or tests which are relied upon to establish the fire rating. On the basis of the seal detail drawings supplied by the licensee, the staff concludes that there is no significant difference between the tested configurations and the design of the Davis-Besse penetration seals.

During its review of the penetration seals, the staff noted that the licensee appeared to take credit for a fire test that was not performed by an independent testing laboratory. In its letter dated February 12, 1987, the licensee withdrew the subject test report and substituted others that were all performed independently. On this basis, the staff's concern is resolved.

The staff also noted that some of the tests on conduit penetrations of fire barriers featured internal conduit seals. The staff requested confirmation that conduits in the plant are sealed internally per the design specifications. The licensee provided information on this issue in a meeting with the staff on February 17-18, 1987 and in its letters dated February 12, 1987 and May 27, 1987. In summary, for conduits which are greater than 4 inches in diameter which penetrate required fire barriers, the licensee installed a 3-hour seal at the barrier or at the termination point if the termination point is 5 feet or less from the barrier. In addition, a seal was provided at the termination point at sensitive electronic equipment if the termination point is 5 feet or less from the barrier. The licensee provided references to seal specifications showing these configurations. For conduits less than 3/4-inch, no seal is provided on the basis of test results showing that openings this small do not require sealing. The methods described in these letters for internal conduit seals have been found acceptable by the staff at other nuclear power plants on the basis that sealed conduits will not experience internal fire spread and that no significant fire propagation will occur in the smaller unsealed configuration. On this basis, the staff concludes that this issue is resolved.

The staff also noted that in a certain fire test, "M-Board" was used as part of the tested assembly. The staff requested confirmation that where credit was taken for fire retardant properties of M-Board in a seal assembly, the in-plant configuration actually uses the board for this purpose. The licensee responded in its letter dated February 12, 1987 indicating that seal inspection procedures confirm that in-plant configurations match the "typical" seal detail. The licensee further stated that the fire rating of any seal assembly is not dependent on the presence of the M-Board in an assembly in those tests relied upon to qualify in-plant seal; it is only necessary as a damming material. On this basis, the staff concludes that this issue is resolved.

The staff noted that in certain fire tests, the "cold-side" temperatures exceeded the temperature limits in the acceptance criteria of ASTM E-119. The staff's initial concern was that secondary fires could occur involving combustible material on the protected side of certain penetration seals. The licensee provided a detailed discussion of this issue in the letter cited above and in a supplemental response dated February 8, 1988. The

staff agreed with the licensee's justification that intervention of the plant fire brigade to suppress a fire will occur well before a sufficient temperature is reached on the protected side of the fire barrier penetration seals to cause combustible materials to ignite, such as cable jackets whose properties are equivalent to those required by IEEE Std. 383.

Finally, the initial group of test reports included several which the staff concluded did not adequately qualify seal details. However, based on the licensee's current seal program, the staff concludes that the test reports presently relied upon are acceptable. Based on the above evaluation and the verification in the April 1990 Appendix R audit inspection that the seal specifications were implemented in the plant, the staff concludes that the issues documented in the licensee's letters dated February 12, 1987 and February 8, 1988, and the concerns raised in the initial regional inspection, are now resolved.

During its review of fire barrier penetration protection, the staff requested confirmation from the licensee that bus ducts, seismic gaps and spare conduit sleeves are sealed with fire-rated material equivalent to the rating of the barrier in which they are located. The licensee described its seal program for these features in its letter dated May 27, 1987. The licensee did not commit to provide fire-rated seals equivalent to the rating of the barrier. Where equivalent rated seals have not been installed, the licensee has assessed seal adequacy on the basis of an evaluation conducted in accordance with the guidance issued in Generic Letter 86-10. The acceptability of the licensee's program for bus ducts, seismic gaps and spare conduit sleeves was confirmed in the April and May 1990 Appendix R audit inspections.

In its comparison of electric cables and cable penetrations of fire barriers with the guidelines of Appendix A to BTP, the licensee identified several deviations. The first was that not all cable trays outside of the cable spreading room are protected by automatic water sprinkler systems. However, based on the licensee's written description of the fire protection program, the staff concludes that those cables necessary for safe shutdown following a fire and those areas containing a quantity of cables which represent a significant fire hazard, are adequately protected by a combination of active (i.e., fire detection and suppression) and/or passive (i.e., fire barriers) fire protection features.

The licensee indicated that fire tests used to qualify electric cable initially installed in the plant did not conform with the methodology required by IEEE Standard No. 383; rather, an alternative fire test methodology was utilized. However, based on the levels of fire protection (e.g., fire detection, fire suppression and fire barriers) provided for safe shutdown systems and hazardous areas as described in the FAOR, Revision 1 and subsequently in Revision 12 of the FHAR, the staff concludes that this deviation is acceptable.

The licensee indicated that some exposed polyvinyl chloride (PVC) jacketed cables are used in the plant in limited quantities in computers and electronic cabinets. The staff does not consider PVC cables enclosed in

conduits to be a significant hazard. Because the quantity of exposed PVC cables is minimal, the staff also concludes that no appreciable hazard exists in the plant. On this basis, the staff concludes this deviation is acceptable.

Finally, the licensee stated that cables are run above the ceiling in the control room and that this concealed space is not protected by a halon fire suppression system as recommended in Appendix A to the BTP. Because the cables are installed in conduit and exist in limited quantities, the staff concludes that they pose no significant fire hazard. Therefore, the staff concludes that the lack of a fixed fire suppression system for these cables is acceptable.

Lighting and Ventilation

The staff issued an exemption from certain requirements of Appendix R to 10 CFR Part 50. A portion of this exemption dealt with the emergency lighting units having at least an 8-hour battery power supply in accordance with Section III.J of Appendix R (Item 5 of the exemption). In the subject exemption, the staff found that the licensee could use the existing "hard-wired" AC/DC essential lighting systems in the event of a fire in either the control room or in the cable spreading room. The staff also found that the use of hand-held lighting units while conducting manual operations in outside plant areas to be acceptable. In the exemption cited above, the staff also found that the illumination in certain areas of the plant was acceptable on the basis of the installation of additional emergency lighting units and the repositioning of others following a plant walkdown by the licensee.

The lighting issue was also considered in the on-site audit inspections in April and May 1990 of the implementation of Appendix R requirements as reported in Inspection Report No. 50-346/90007. Specifically, in Section 3.c of this report, the NRC staff found that the licensee had addressed all of its concerns regarding emergency lighting based on the licensee's commitments to: (1) perform an additional lighting test; (2) install additional emergency lighting units in marginal areas; and (3) modify its documentation to remove an incorrect assumption. The licensee indicated in a telephone conference on February 26, 1991, that it had implemented these commitments. The evaluation in Section 3.c of the inspection report cited above confirms the staff's prior conclusions regarding emergency lighting in the exemption issued on April 18, 1990. While the audit inspection team reviewed this matter using Revision 1 to the FAOR, this finding is still valid on the basis that the present documentation (i.e., FHAR, Revision 12) contains the same information.

For post-fire safe shutdown actions within the fire area where emergency lighting units may be damaged, portable lighting units will be utilized. The staff finds this acceptable for manual operation of equipment required to achieve safe shutdown.

In its comparison of the Davis-Besse fire protection program with the guidelines contained in Appendix A to the BTP, the licensee identified several deviations related to the design of the HVAC system. Contrary to

the above criteria, in some locations cables and controls for ventilation systems are located within the area served by that system. The staff was initially concerned that a fire could damage the HVAC system, complicating smoke removal during and following a fire. The licensee responded to this concern in its letter dated January 6, 1988 stating that in the event that HVAC systems are damaged by a fire, smoke removal will be accomplished manually by the plant fire brigade using portable fans and flexible ducting ("elephant trunks"). The pre-fire plans of the site fire brigade address smoke removal during a fire. This provides reasonable assurance that safety systems that are being relied upon during the fire are not adversely affected by smoke removal activities. On this basis, the staff concludes that this deviation is acceptable.

The licensee identified a deviation from staff fire protection criteria in that unit charcoal filters are not protected by fire suppression systems. Instead, the licensee has stated in the letter cited above that the filters have been provided with design features such that the ventilation system will not experience a level of heating induced by radioactivity trapped in the filters which would be sufficient to ignite the charcoal filter. This alternative is accepted by the staff as satisfying the criteria of Regulatory Guide 1.52 for the design of charcoal filter units. On this basis, the staff concludes that the subject deviation is acceptable.

IV. FIRE PROTECTION FOR SPECIFIC AREAS

Control Room

In its May 27, 1987 letter to the staff, the licensee described new carpeting which has been installed in the control room. The carpeting has not been qualified to the standard fire test method delineated in ASTM E-84. Instead, the carpeting was subjected to the radiant panel test of ASTM E-648. The results of this latter test establish that the carpeting has a level of fire resistance equivalent to Class A-type carpeting. The staff, therefore, concludes that the use of this carpeting in the control room is acceptable.

In Revision 7 of the FHAR, the licensee stated its assumption that the design of the control room is such that a fire would not spread from one essential cabinet to its redundant counterpart. The staff responded that this position was not valid and that for all fire areas, including the control room, the licensee should assess the adequacy of fire protection for safe shutdown system on the basis that all cables and components within the fire area are damaged, except where systems within a fire area are protected in accordance with Section III.G of Appendix R to 10 CFR Part 50 or by an equivalent level of protection that the staff has specifically reviewed and approved. The licensee subsequently changed its fire hazards analysis to be consistent with the staff's position. On this basis, the staff concludes that this issue is resolved.

Containment

In the exemption issued on April 18, 1990, the staff found in the section related to Fire Area D that the licensee's proposal for the three redundant

containment air cooler fans (i.e., C1-1, C1-2 and C1-3) was acceptable (Item 6 of the exemption). The staff, therefore, granted the licensee's request for an exemption from the requirement of Section III.G.2.d of Appendix R.

The licensee identified a deviation from the guidelines contained in Appendix A to the BTP in that there are no standpipes and hose stations within the reactor containment. This deviation has previously been approved by the staff in the original safety evaluation of the Davis-Besse Fire Protection Program.

The licensee noted that the steel instrument tubing for the pressurizer level transmitters will not be protected because the tubing is not subject to damage by the temperatures expected to be produced by a fire in this area. The staff evaluated the licensee's justification and concludes, based on the licensee's fire hazards analyses, that protection of the tubing is not necessary.

The staff requested clarification as to the nature of the radiant energy shielding inside the reactor containment. The licensee supplied this information in its letter dated May 27, 1981. Subsequently, in its letter dated October 26, 1989, the licensee revised its commitment to provide shielding having a 1-hour fire rating and, instead, install shielding to that having a 1/2-hour rating. This is in accordance with the guidance in Generic Letter 86-10 and is, therefore, acceptable.

Cable Spreading Room

In its comparison of the fire protection program with staff guidelines, the licensee identified a number of deviations in the cable spreading room. Specifically, aisle dimensions between cable trays and divisional cable separation are not in accordance with Appendix A to the BTP. The staff does not consider these deviations significant because the room is protected by an automatic fire detection system and an automatic, wet-pipe sprinkler system, which provides reasonable assurance that any potential fire will be detected early and controlled before significant heat and smoke generation occurs. The congested aisles would tend to limit fire brigade accessibility but this would, at most, delay the arrival of the fire brigade at the origin of the fire. Because of the active fire protection features in the room, this delay is judged to be not significant.

The lack of divisional separation of cables is also not considered significant because of the fire protection features cited above. In addition, the licensee has provided an alternate shutdown capability which is physically and electrically independent from the cable spreading room. Thus, if redundant safety-related cables were damaged by fire in this area, safe plant shutdown could still be achieved and maintained. On this basis, the staff concludes that the subject fire protection deviations in the cable spreading room are acceptable. During the course of its review, the staff requested and received drawings of the sprinkler system in the cable spreading room. A review of these drawings did not contradict the staff's conclusion regarding the acceptability of the fire protection measures in the cable spreading room.

Switchgear Rooms and Safety Related Pumps

The licensee noted that, contrary to staff guidance in Appendix A to the BTP, automatic fire suppression systems are not provided in switchgear rooms and certain safety-related pump areas. Details relating to the configuration of the areas, including fire hazards and available protection are provided in Revision 12 to the FHAR. The staff reviewed the licensee's fire hazards analysis and concludes that the existing level of protection, which includes fire detection, fire-rated barriers and manual fire fighting equipment, is sufficient to mitigate the hazard. In addition, the licensee has determined that at least one division of post-fire safe shutdown systems will remain free of damage in accordance with the applicable Appendix R requirements. The staff, therefore, concludes that the lack of an automatic fire suppression system in the subject areas is acceptable.

Diesel Generator Oil Storage Areas

The licensee identified several deviations from the guidance in Appendix A to the BTP in the subject areas pertaining to the lack of full boundary 3-hour fire-rated construction which separates these areas from adjoining plant locations. The hazards associated with the existing conditions are mitigated by the presence of active fire protection features such as fire detectors and suppression systems on at least one side of the barrier. The staff has evaluated the fire hazards as described by the licensee in comparison with the available protection and concludes that these conditions are acceptable.

Safety-Related Water Tanks

The borated water storage tank is coated with a foam insulation. The licensee affirms that the insulation has a flame spread rating of 25 when measured in accordance with the test method of ASTM Standard E-84. A hose house with sufficient lengths of fire hose to fight a fire at the tank is present in the area. Because the flammability characteristics of the insulation meet the staff guidelines in Appendix A to the BTP and because manual fire fighting equipment is available, the staff concludes that the foam insulation on the tank is acceptable.

Multiple Locations - General Issues

In the exemption issued on April 18, 1990, the staff granted relief from the requirements of Appendix R to 10 CFR Part 50 for eight separate areas of the Davis-Besse facility. Two of these have been discussed in the preceding sections of this safety evaluation; the remaining six items are briefly discussed below. In this exemption, the staff found in the sections related to Fire Areas R, EE and AB (Items 1, 2 and 3 of the exemption) that the licensee's proposal to provide an alternative shutdown capability was acceptable. On this basis, the staff granted the licensee's request for an exemption from the requirement of Section III.G.3 of Appendix R for the three subject fire areas.

The staff also found in this exemption that the licensee had demonstrated that there is presently an acceptable level of fire protection within Fire Area A (Item 4 of the exemption). On this basis, the staff granted an exemption from the requirements of Section III.G.2 of Appendix R which states that a 3-hour barrier be placed between redundant safe shutdown systems.

The staff found in this exemption that there is a negligible potential for a fire in manhole MH3001 (Item 7 of the exemption) which could damage the redundant circuits in this manhole. On this basis, the staff granted an exemption from the requirement in Section III.G.2.b of Appendix R which requires in part that cables and associated nonsafety circuits located in the same fire area outside of primary containment and necessary to achieve and maintain hot shutdown conditions, be separated by a horizontal distance of more than 20 feet.

Finally, in the eighth item of this exemption, the staff found that the licensee had provided an acceptable level of fire protection, on a conservative basis, for certain cables of electrical circuits which are enclosed in conduit embedded in concrete walls, floors and ceilings. On this basis, the staff granted an exemption from the requirement of Section III.G.2.a of Appendix R which requires in part that cables and associated nonsafety circuits of redundant circuits needed to achieve safe shutdown be separated by a fire barrier having a 3-hour rating.

During its review of the Davis-Besse fire protection program, the staff expressed concern that the licensee may not have adequately planned to deal with the smoke produced by a fire. Specific concern centered on the venting of products of combustion to avoid damage to redundant shutdown equipment. The licensee responded to this concern in its letter dated May 27, 1987 by committing to revise the Fire Protection Strategy Procedures to prioritize the methods of smoke venting so as to minimize the potential impact of smoke on sensitive electrical equipment. The staff reviewed the licensee's proposals and concludes that this is acceptable in that the licensee has provided a prioritized multiple step approach to achieve this goal. The licensee indicated in a telephone conference on February 26, 1991, that it had implemented the subject revisions to the procedures cited above.

The staff requested that the licensee provide information to verify the adequacy of the plant communications capability during and after a fire. The staff was specifically concerned that the structural steel in the Davis-Besse plant would interfere with radio communications. The licensee responded in its letter dated May 27, 1987 by providing a description of the multi-faceted communication capability. In the event that one part of the system may be rendered inoperable, such as the "Gai-Tronics" system, the remaining communications capability, including radios and sound-powered phones, would be available. The licensee also performed and documented a verification test of the radio and sound-powered phone system in those plant areas requiring manual operator actions for post-fire safe shutdown. This test verified that the communications capability is effective for assuring

safe shutdown following a fire. On this basis, this issue is considered resolved. This matter was also reviewed during the Appendix R audit inspections in April and May 1990 and was closed in Inspection Report No. 50-346/90007. (Refer to Section 3.d.)

In its comparison of the plant fire protection program with the guidelines in Appendix A to the BTP, the licensee identified a deviation pertaining to the combustibility of piping and ductwork insulation. Staff guidelines stipulate that insulation material should have a flame spread, smoke and fuel contribution rating of 25 or less as determined by the test method of ASTM E-84. As indicated by the licensee in its letter dated January 6, 1988, the insulation meets the flame spread rating but exceeds the smoke and fuel contribution rating. However, the staff concludes that the degree of deviation is insignificant from a safety standpoint based on the relatively limited quantity of insulation compared to other in-situ combustible materials and the active and passive fire protection features that comprise the defense in depth philosophy of fire protection at the plant. The staff, therefore, concludes that this deviation is acceptable.

The licensee identified several deviations from the criteria delineated in NFPA Standard No. 10 which applies to portable fire extinguishers. The principal deviations pertain to the spacing and accessibility of fire extinguishers. During its evaluation of the licensee's code conformance analysis, the staff disagreed with several of the licensee's assumptions, such as the use of hose stations in lieu of Class A-type extinguishers, and the use of CO_2-type extinguishers to control Class A-type fires. Additional information on this issue was provided by the licensee in a meeting with the staff on August 15, 1989 and by its letter dated October 11, 1989. In an effort to resolve its concerns, the staff conducted a walkdown of certain areas in the turbine and auxiliary buildings where deviations had been identified by the licensee. The staff observed that all of the locations audited had been provided with a sufficient number of extinguishers of the proper type even though the type and placement of the fire extinguishers are not in strict compliance with the applicable NFPA Code. On the basis of this sample of fire areas, plus the licensee's justification, the staff concludes that the number, type and placement of fire extinguishers in the plant is acceptable.

During its review of the NFPA conformance analyses, the staff requested clarification on a number of issues including the lack of automatic shutoff valves for some of the flammable liquid tanks, maintenance of hydrogen system features, and ventilation in Seal Oil Room No. 333. The licensee provided satisfactory responses to these requests in its letter dated October 11, 1989. On this basis, the staff concludes that this issue is resolved.

V. ADMINISTRATIVE CONTROLS, FIRE BRIGADE AND TECHNICAL SPECIFICATIONS

Supplemental guidance regarding fire protection function responsibilities, administrative controls and quality assurance was issued by the staff in its letter dated August 29, 1977. The staff later requested the licensee to provide confirmation that the fire protection program at Davis-Besse conforms with this guidance. The licensee responded in its letter dated

May 27, 1987 in which the licensee stated that, with one exception, the plant fire protection program conforms with this guidance. The single exception concerns the application of the guidance, retroactively, to the design, procurement, construction and pre-operational testing of fire protection systems installed prior to the staff's letter of August 29, 1977. The deviation identified by the licensee does not encompass fire brigade organization, training and procedures or control of combustible materials and ignition sources as delineated in the subject letter. The deviation does apply to some of the quality assurance aspects of the letter, such as documentation relating to the procurement of materials. The staff considers the deviation acceptable because the design, construction, procurement and testing of fire protection systems are also governed by the relevant sections of Appendix A to the BTP and the pertinent NFPA codes. The staff has reviewed the licensee's comparison of the fire protection program with the guidelines in Appendix A to the BTP as described previously in its safety evaluation dated July 26, 1979 and has concluded that the licensee's fire protection program is acceptable.

With regard to the lack of quality assurance documentation for work performed prior to 1978 on fire protection systems, the staff concludes that the past performance of the systems without discernible degradation provides reasonable assurance that these systems will perform acceptably in the future. Furthermore, any degradation that might occur would be corrected by the compensatory measures required by the Davis-Besse plant procedures. The staff concludes, therefore, that the lack of the quality assurance documentation for work performed prior to 1978, is acceptable.

During a plant inspection, the staff expressed its concern that the plant fire brigade was not being dispatched immediately to a fire area upon receipt of a fire alarm in the control room. The staff was specifically concerned that there may be particular areas in the plant containing redundant shutdown systems which might be damaged if the fire brigade response was delayed. The licensee responded to this concern in its letter dated September 30, 1989 in which it described criteria by which individual plant fire areas were evaluated for potential vulnerability. Three locations were identified by the licensee as requiring the immediate assembly of the brigade. These are Room Nos. 323, 404, and 428. The staff expressed its concern that the licensee's criteria would not require the dispatch of the brigade if multiple alarms of a certain type were received such as multiple alarms from the fire detection system. The licensee stated in its letter dated September 30, 1989 that multiple fire detector alarms from adjacent fire zones would be considered diverse, thereby requiring dispatch of the fire brigade. The licensee provided additional clarification in its letter dated February 20, 1990. The staff reviewed the licensee's approach to this issue in its latest submittal and concludes that it provides reasonable assurance that the fire brigade response will be timely in those areas which contain potentially vulnerable redundant shutdown systems. The staff concludes that this issue is resolved.

During its review of those issues related to the fire brigade, the staff inquired about the status of the licensee's update of brigade pre-fire plans. The licensee responded in its letter dated May 27, 1987 that the fire brigade pre-plans have been upgraded after consultation with the staff

as documented in an NRC meeting summary dated February 1, 1984. The update included the delineation of fire hazards and floor layout and reflects the revised safe shutdown methodology and existing fire-rated barriers and fire fighting systems. Subsequently, the licensee stated in its letter dated February 20, 1990 that it had revised its pre-fire plans to remove the safe shutdown methodology from these plans to avoid duplication and possible confusion with the separate safe shutdown procedures. On this basis, the staff concludes that this issue is resolved.

During its review of the licensee's comparison of the fire protection program with NFPA Standard No. 7, the staff expressed its concern that relevant portions of the standard relating to planning and coordination with public fire departments were considered by the licensee to be not applicable. The staff was specifically concerned that there was no agreement with the offsite fire department to respond to an emergency at the plant, if requested, and that there was no planning and training with the offsite department to familiarize them with the characteristics of the various fire zones in the plant.

In response, the licensee stated that its position on the above issues was delineated in Table 4-1 of the FHAR; this position is now contained in Appendix D of Revision 12 of the FHAR. An agreement with the offsite fire department does exist which covers mutual responsibilities in the event assistance is requested. In addition, periodic training is performed with available personnel from the local fire department so as to facilitate effective assistance in the event that it is needed. While the plant fire brigade is staffed and equipped to deal with all anticipated fire-related incidents, in the unlikely event that an unusual incident may be beyond the capabilities of the Davis-Besse fire brigade, offsite assistance will be provided. On this basis, the staff concludes that the licensee's position delineated in Appendix D of Revision 12 to the FHAR, meets the requirements of NFPA Standard No. 7.

In a related matter, the staff expressed concern that the responsibilities of a Fire Loss Prevention Manager, required in Section 310 of NFPA Standard No. 6, were considered by the licensee to be not applicable to Davis-Besse. The licensee's position on this issue is contained in Appendix D of the FHAR, Revision 12. The staff was concerned that responsibilities such as reviewing fire protection inspection findings, training programs, procedures and the financial aspects of fire losses were not part of the responsibilities of the Davis-Besse Fire Protection Compliance Supervisor.

The Fire Protection Compliance Supervisor is responsible for all programmatic aspects of the Davis-Besse Fire Protection Program. Specific review, audit, engineering and training responsibilities are delegated, if necessary, to qualified individuals within the licensee's organization. On this basis, the staff concludes that the licensee's position is in accordance with Section 310 of NFPA No. 6.

The staff requested the licensee to provide clarification about whether training of the fire brigade is in accordance with NRC fire protection guidelines. The licensee stated in its letter dated July 31, 1989 that its fire brigade training program is in accordance with the drill

and instructional guidelines for fire brigades delineated in Appendix A to the BTP and the staff's supplemental guidance contained in its letter dated August 29, 1977. On this basis, the staff concludes that this issue is resolved.

In its letter dated February 25, 1988, the NRC issued Amendment No. 106 to the Davis-Besse operating license which revised certain fire protection plant Technical Specifications (TSs). These TS changes are considered transitional in that not all aspects of the approved fire protection program at the plant have been incorporated into the TSs. For example, certain fire barrier and safe shutdown components upon which the licensee relies to satisfy NRC fire protection criteria, have not been incorporated into the Davis-Besse Technical Specifications. To resolve this issue, the licensee stated in its letter dated July 20, 1990, that it would remove from the Davis-Besse TSs, those portions related to fire protection pursuant to guidance contained in Generic Letter 86-10. The time frame to accomplish this would be within 6 months after issuance of this safety evaluation. Since this issue will be resolved by a forthcoming submittal, this item is closed.

The licensee stated in its letter dated July 31, 1989 that in its NFPA Codes conformance review, the frequency of inspections and surveillance testing of certain fire protection systems at the Davis-Besse plant differs from the recommendations in the NFPA Codes. The staff, however, considers the surveillance and testing requirements of the Davis-Besse TSs to be the basis of an acceptable program. The staff concludes, therefore, that the subject NFPA deviations are acceptable.

The Action Statements of certain fire protection TSs state that an hourly fire watch patrol must be implemented when degraded fire protection features are discovered, provided that an operable fire detection system is installed in the area. In its letter dated July 28, 1989, the licensee described its intent to utilize a portable fire detection system, as required under limited circumstances, to compensate for degraded fire protection features. An alarm signal from this portable system would be transmitted via a telephone circuit to the Control Room, the Central Alarm Station and the Secondary Alarm Station. The staff was concerned that the placement of the detectors would not conform with the guidance provided in NFPA Standard No. 72E. The licensee stated in its letter dated July 28, 1989 that it will follow these guidelines except where special circumstances may warrant an alternative configuration. In such an instance, a qualified fire protection engineer will decide the position of these portable detectors. The licensee also committed in the same letter that it will utilize this concept of a portable detection system only in conjunction with hourly fire watch patrols. On this basis, the staff concludes that the licensee's proposal is acceptable.

Finally, in its comparison of the fire protection program with the criteria of NFPA Standard No. 30, the licensee identified a deviation in its letter dated July 31, 1989 pertaining to the quantity of flammable and combustible liquids located outside of any storage area. To evaluate this issue, the staff reviewed Administrative Procedure DB-FP-00007 (Revision 00) which covers the control of transient combustibles. The procedure limits quantities of flammable and combustible liquids as well as other combustible materials to that necessary for plant operations. When excess quantities are

present in an area, prior approval per the procedure is necessary and, in certain configurations, additional compensatory fire protection measures are taken. The staff concludes that the subject procedure, and the noted deviation from NFPA Standard No. 30, are acceptable.

VI. POST FIRE SAFE SHUTDOWN CAPABILITY

Introduction

The NRC criteria which is applicable to the Davis-Besse post-fire safe shutdown capability is contained in Sections III.G and III.L of Appendix R to 10 CFR 50, in Generic Letter 81-12 and its subsequent clarification in Generic Letter 86-10.

The licensee's description of the methodology for achieving and maintaining post-fire safe shutdown previously was contained in the CAR through Revision 3. When the staff evaluated the information provided in Revision 1 of the CAR, it expressed its concern that the licensee's approach to several issues was not in accordance with the criteria cited above. The staff also requested clarification and additional information on several other issues in order to be able to determine the acceptability of the licensee's technical approach. In response, the licensee provided additional information on its safe shutdown methodology in letters to the staff dated May 27 and July 30, 1987; January 6, February 8, May 23, June 6, and August 9, 1988; March 15, 1989; and May 10, 1990. It also incorporated changes to the methodology in subsequent revisions to the CAR and the FAOR. This correspondence forms the basis of the licensee's program and was reviewed in the April and May 1990 Appendix R audit inspections. As previously discussed, Revision 12 of the FHAR submitted on November 8, 1990, now contains all the information previously reviewed by the NRC staff and by the audit inspection teams.

Methodology For Assuring Post-Fire Safe Shutdown

The performance goals for safe shutdown functions are contained in Section III.L of Appendix R to 10 CFR Part 50. The licensee has stated that the safe shutdown methodology is sufficient to satisfy these performance goals as described below.

Reactor Reactivity Control

Safe shutdown of the reactor is performed by a manual trip from the control room in the event of a fire. An automatic trip will occur in the event of loss of offsite power. After a reactor trip, the reactivity control function provided by the control rods and the boration injection systems is capable of achieving and maintaining at least a 1% reactivity shutdown margin (Δ k/k) from zero power, hot standby to cold shutdown. The shutdown function is capable of compensating for any reactivity changes associated with xenon decay and the reactor coolant temperature decrease which occurs during cooldown to cold shutdown conditions.

The makeup and purification system (MUPS), high pressure injection system (HPIS) and low pressure injection system (LPIS) provide boron injection for subsequent reactivity control during cooldown. The makeup pumps take

suction from the makeup tank or borated water storage tank (BWST). The HPI and LPI systems take suction from the BWST.

Reactor Coolant Pressure and Level Control

The reactor coolant make-up control function is capable of assuring that sufficient inventory is provided to compensate for reactor coolant system (RCS) fluid losses due to leakage from the RCS water volume during cooldown from hot standby to cold shutdown conditions, and to compensate for contraction of the RCS. The same systems are used for this function as those previously mentioned for the reactor reactivity control function.

Reactor coolant pressure control is provided by the pilot-operated relief valve (PORV) or the pressurizer vent header valves as a backup, if available.

Decay heat removal in hot standby is accomplished by natural circulation through the use of the auxiliary feedwater pumps supplying water to the steam generators from the condensate storage tanks and rejecting heat from the steam generators to the atmosphere through the atmospheric vent valves or the main steam safety valves as a backup. In the event of a long-term plant cooldown, a backup supply of auxiliary feedwater is provided from the service water system.

Decay heat removal in cold shutdown is provided by the decay heat removal system (DHRS) through the decay heat coolers. The component cooling water system (CCWS) provides cooling to the decay heat coolers, and is in turn cooled by the service water system (SWS).

Secondary System Pressure and Level Control

The secondary system pressure in the steam generators is maintained within allowable limits by operation of the atmospheric vent valves. The steam generator water level is maintained by the auxiliary feedwater system or the motor driven feedwater pump as an alternate. Normally, steam generator water level is maintained by the main feedwater system. However, on a loss of offsite power, this system is not available.

Process Monitoring

Monitoring information on process variables is available from the control room or local control stations. The process monitoring function is capable of providing direct readings of those plant process variables necessary for plant operators to perform and/or control the identified safe shutdown functions.

Supporting Systems

The systems and equipment used to perform the previous functions require miscellaneous supporting functions. The supporting functions required include process cooling (CCWS and SWS), area cooling for certain rooms (HVAC) and essential AC/DC power. The supporting functions are protected from fire damage as described in Revision 12 of the FHAR and are capable of providing the support necessary to assure acceptable performance of the previously identified safe shutdown functions.

stated demonstrates that no seal failure or significant leakage will occur due to loss of seal cooling for 39 hours or as a result of sudden restoration of seal cooling water. The licensee committed nevertheless to re-establish seal cooling well within 39 hours after its loss.

The licensee evaluated the results of the RCP seal test and the available methods of providing seal cooling at Davis-Besse. It was initially concluded that the preferred method of seal cooling is seal injection via the Makeup (MU) or high pressure injection (HPI) systems and that this method could be established well within 39 hours without physical modifications with controlled seal staging isolated. However, the seal test to which the licensee referred was conducted with controlled seal bleedoff without any isolation. The licensee determined that a single exposure fire in certain plant fire areas could cause controlled seal bleedoff to be isolated. The licensee has been unable to locate data from other tests which would demonstrate that the controlled seal bleedoff may be isolated without any seal cooling and not lead to RCP seal failure. Consequently, the time to implement the manual operator actions for seal injection via the MU or HPI system may not be adequate in plant fire areas where a single exposure fire could be postulated to cause the isolation of controlled seal bleedoff and the loss of CCWS seal cooling.

The licensee committed in its letter dated February 8, 1988 to identify whether CCWS seal cooling would be assured as being available following a fire or whether controlled seal bleedoff flow could be assured in the event of a fire and to identify any associated modifications or manual actions. The licensee submitted information to demonstrate that RCP seal integrity is maintained. The staff is currently reviewing this issue on a generic basis; in the interim, the staff believes that the test results submitted by the licensee justifies continued operation.

The licensee has identified in its letter dated February 16, 1990 those manual operator actions required to re-establish seal injection via the MU or HPI systems. These manual operator actions would be adequate in those fire areas in which a single exposure fire would not cause the isolation of controlled seal bleedoff and involve repositioning certain valves or verifying that these valves are opened. Additionally, the licensee has evaluated the location of these valves relative to the location of any fire postulated to cause the loss of all RCP seal cooling. Based on this evaluation, the licensee has stated in the letter cited above that certain HPI and MU valves could be subjected to the postulated exposure fire and also require subsequent manual operation in order to establish seal cooling. The staff evaluation of these manual actions is discussed later in this evaluation.

As part of its review of the licensee's safe shutdown methodology, the staff requested that the licensee discuss the implications of Information Notice 86-79. The staff was concerned that systems required for shutdown following a fire which are provided with a "swing" capability can be degraded or lost as a result of design deficiencies in interlocking circuitry or inadequacies in maintenance procedures. The licensee provided

the results of their review of this issue in its letter to the staff dated July 30, 1987. The licensee indicated that the only post-fire safe shutdown components that feature a swing design are the CCWS and the service water system and that the design of these systems is such as to not cause a loss of function as delineated in the information notice. On this basis, this issue is resolved.

Based on the lack of sufficiently explicit information in Section 3.0 of the CAR, the staff requested confirmation that all emergency diesel generator (EDG) auxiliary systems had been analyzed for conformance to the requirements of Appendix R to 10 CFR Part 50. The licensee provided a description of the required EDG auxiliary systems in its letter dated May 27, 1987 and described the measures it has provided to assure that loss of function will not occur as a result of a fire. The staff reviewed the licensee's response and concludes that it is acceptable. Since Revision 12 of the FHAR incorporated the licensee's response in the letter cited above, our conclusion remains unchanged.

The licensee originally proposed to compensate for damage to redundant EDG fuel oil transfer pumps by providing a backup source of fuel (i.e., a tank truck) from a local offsite source. The staff concluded that this approach was not justifiable on the basis of potential unanticipated events which might prevent the tank truck from reaching the site in sufficient time. In its letter dated May 27, 1987, the licensee proposed an alternate solution. The main fuel oil tank has an adequate supply of fuel oil which exceeds the 193 hours of EDG operation necessary to achieve post-fire safe shutdown. A pipe from this tank enters Room 319 containing EDG 1-2. The licensee has installed an isolation valve with a hose connection on this pipe and uses existing transfer pumps to transfer fuel oil from the main fuel oil tank to the EDG day tank 1-2 located in Room 320A, adjacent to Room 319 as described in its letter dated February 16, 1990. This was verified during the April and May 1990 Appendix R audit inspections.

This alternative source of fuel would not be required for a fire in Rooms 319 and 320A. Because this installation assures a sufficient onsite source of fuel to the EDGs without reliance on an offsite capability, the staff concludes that this modification is acceptable.

The staff requested clarification as to how valve operators will be protected from fire damage. The licensee stated in its letters dated May 27, 1987 and February 16, 1990 that its safe shutdown methodology is predicated on the assumption that certain passive components are assumed to remain functional during a fire. The staff agrees that heat exchangers, piping, tanks as well as manual valves and check valves will not be damaged by a credible plant fire based on the implementation of the licensee's defense-in-depth philosophy. Where valve repositioning is necessary for safe shutdown, the licensee stated in its letter dated May 27, 1987 that it will rely upon manual operator actions.

The staff's evaluation of manual actions is discussed later in this evaluation. On the basis that valves in shutdown flow paths feature no device or component which is subject to fire damage that would prevent manipulation by a plant operator, this issue is resolved.

In reviewing the original and subsequent revisions of the CAR, the staff noted a number of operator actions that were not in conformance with the provisions of Appendix R to 10 CFR Part 50 or the guidance contained in Generic Letter 81-12. Examples of these operator actions include cutting wires and certain repairs to achieve hot shutdown. The licensee responded that these actions reflected interim actions approved by the staff and implemented by the licensee as part of their response to the original Appendix R regional audit. Subsequent revisions to the CAR, to Revision 1 to the FAOR and the documentation in Revision 12 to the FHAR reflect the ongoing implementation of modifications and procedures which conform with staff fire protection criteria. As noted previously, the licensee implemented those modifications and procedures related to the requirements of Appendix R to 10 CFR Part 50 prior to restart after the sixth refueling outage (i.e., prior to July 1990). Those modifications related to Appendix A to the BTP remain as ongoing items which will be implemented during either the seventh or eighth refueling outage. On this basis, the staff concludes that this issue is resolved.

Alternate Shutdown Capability

In most areas of the plant, the licensee has provided fire protection sufficient to assure that one train of safe shutdown systems is free of fire damage. In several fire areas originally delineated in the CAR and presently documented in Revision 12 to the FHAR, the licensee states that plant operators will perform manual actions, such as valve manipulation, to compensate for fire damage to circuits required to achieve shutdown conditions. Because these actions are associated with normal shutdown systems (Train 1 or 2), they are not considered to be part of the alternate shutdown capability. Instead, compliance is achieved on the basis of Section III.G.1 of Appendix R to 10 CFR Part 50. For the remaining areas described in Sections 1.4 and 4 of Revision 12 to the FHAR, the licensee has provided an alternate shutdown capability which, with several exemptions previously approved by the staff, the licensee states is in conformance with Section III.L. of Appendix R and the supplemental guidance contained in Generic Letters 81-12 and 86-10.

For a fire in the control room or cable spreading room, the licensee will implement its procedure titled "Serious Control Room Fire." This procedure is predicated on a series of actions such as tripping breakers and locally operating components manually or by a local controller. For a fire in other plant areas, the licensee will implement its procedure titled "Serious Station Fire."

The staff initially had several concerns with the licensee's alternate shutdown approach. The first was that the performance goals for the alternate shutdown function, as required by Section III.L. of Appendix R, may not have been met. At Davis-Besse as with other pressurized water reactors, some plant transients of short duration may cause certain reactor coolant process variables and their indications, such as pressurizer level, to exceed those predicted for a loss of offsite power. These transients would occur for a short period and could result from a delay in reactor trip or from a delay in equipment manipulations such as the time to properly realign

auxiliary feedwater valves following fire induced spurious signals. The staff has evaluated the consequences of these transients and concludes that they are not safety significant as long as no unrecoverable plant condition will occur. An unrecoverable plant condition is defined as the loss of any shutdown function(s) for such a duration as to ultimately cause the reactor coolant level to fall below the top of the reactor core and lead to a subsequent breach of the fuel cladding.

The staff's conclusion is also based on the statements made by the licensee in its letter dated June 6, 1988, that the capability to return the pressurizer level to within the prescribed instrument indication range, and to restore other process variables to within the range predicted by a loss of offsite power, will be preserved. In addition, the licensee states that the core will not be uncovered and fission product boundary integrity will not be affected during the postulated transient conditions.

Similarly, a short-term opening of a high-low pressure interface, such as opening the PORV and the PORV block valve due to a spurious actuation from a fire in the control room or cable spreading room, is acceptable as long as the capability to close one of the valves is available by timely manual operator actions which would prevent an unrecoverable plant condition. Based on the staff evaluation of the licensee's capability to respond to this condition and close either the PORV or the block valve independent of postulated fire damage, the staff concludes that this issue is resolved.

The staff was concerned that the alternate shutdown capability may not be physically and electrically independent of the fire area. The staff noted specifically the issues described in Information Notice 85-09. The licensee responded to the issue of physical independence in its submittals relating to manual operator actions; these are evaluated further on in this report. With regard to electrical independence, the licensee also responded in its letter dated May 27, 1987 that isolation switches and fuses have been installed in accordance with Generic Letter 81-12 such that electrical independence of the alternate shutdown capability from the fire area is achieved. On this basis, the staff concludes that this issue is resolved.

In its August 9, 1988 letter, the licensee identified a number of shutdown repairs for which specific approval was requested. One such repair involves the installation and use of a portable digital readout device to measure and monitor reactor coolant system hot and cold leg temperatures.

The normal circuit for each indication would be disconnected via a multi-pin twist disconnect plug and then reconnected to the digital readout device as described in the licensee's letter dated May 27, 1987. Because each action is simple in nature and involves a brief interval to implement, the staff concludes that this type of repair is acceptable.

The licensee will also implement certain precautionary measures not required to satisfy the requirements of Appendix R to 10 CFR Part 50 but which enhance the shutdown capability. These will not significantly delay critical shutdown actions as confirmed by the licensee's time/manpower analyses reviewed during the Appendix R audit inspections conducted in April and May 1990. The staff therefore, concludes that these precautionary measures are acceptable.

Finally, the licensee will utilize portable fans in one area described in its letter dated February 16, 1990 to compensate for damage to HVAC cables and components. The staff had two concerns with this approach. The first was that the fans might not be effective in maintaining an acceptable room temperature. However, the licensee has performed analyses which confirm the viability of this approach as stated in its letter dated February 16, 1990. The staff evaluated these analyses in the April and May 1990 Appendix R audit inspections. The second concern was that the fans relied upon will not be available for use when needed. The licensee stated in its letter dated May 27, 1987 that the fans will be different from those needed by the fire brigade for smoke removal and will be controlled as will other tools and equipment needed for post-fire safe shutdown. On this basis, the staff's concerns are resolved.

The staff was also concerned that sufficient time and personnel were not available to achieve safe shutdown independent of the plant fire brigade. The licensee will not rely upon the plant fire brigade for personnel to implement the shutdown procedures cited above since these procedures will be implemented by operations personnel not assigned to the fire brigade which includes both licensed and non-licensed operators. The staff confirmed the feasibility of the procedures in the April and May 1990 Appendix R audit inspections.

The staff requested clarification regarding the number and nature of operator actions within the control room for which credit is taken following a control room fire that would precipitate an evacuation of the control room. The licensee responded in its letter dated May 27, 1987, in which it stated that nine operator actions are credited in the control room. Two of the actions, reactor trip and turbine trip, are to be completed prior to evacuation of the control room due to a fire. The remaining seven actions may either be taken in the control room, if conditions permit, or they may be completed and verified outside the control room regardless of circuit damage in the control room, in accordance with the procedures cited above. In the event that control room evacuation is necessary, the licensee has analyzed the consequences of circuit damage which may occur from the time evacuation is deemed necessary until electrical isolation is achieved and has confirmed that no unrecoverable plant condition will occur during this interval. The licensee has also prioritized operator actions to focus on time critical activities early in the shutdown procedure. On the basis that a safe, viable method is available outside the control room to implement and verify the remaining seven operator actions, the licensee's response on this issue is acceptable.

The staff was also concerned that as part of the post-fire safe shutdown methodology, the licensee may have taken credit for operator actions within the fire area or that operators may have been directed to travel through the area experiencing the fire in order to reach locations where shutdown-related activities needed to be implemented. The staff was specifically concerned with personnel entry into a fire area within the first hour after the discovery of a fire. Operator entry beyond the first hour is not considered significant because of the intervention of the plant fire brigade to suppress the fire and initiate smoke removal activities in conjunction with its fire procedures. A related concern was that there may be certain critical

actions that need to be taken outside of the control room within a short duration to avoid an unrecoverable plant condition. The staff's specific concern was that there may be an insufficient time margin built into the shutdown procedures to achieve these actions. The staff requested that the licensee's response to this concern focus on the first 30 minutes after a fire is discovered. The licensee responded to these issues in its letters dated June 6 and August 9, 1988 and March 15, 1989. The licensee's response is predicated on the definition of an unrecoverable plant condition cited earlier. The analyses to determine the time to reach this condition is based on the assumption that the fire causes safe shutdown equipment in the fire area to assume their most detrimental positions. This assumption conforms with the guidance issued in Generic Letter 86-10 and is, therefore, acceptable.

In its responses, the licensee assessed all manual actions identified in post-fire safe shutdown procedures. Of these actions, the licensee initially identified 19 actions which needed to be performed within one hour in the fire area and within 30 minutes outside of the fire area.

Upon further review, the licensee concluded in its letter dated March 15, 1989 that four of these actions could be performed beyond these time limits. All but two of the remaining actions were resolved so as to meet the staff's acceptance criteria on the basis of plant modifications delineated in the licensee's letter dated June 6, 1988. An operator action associated with establishing temporary ventilation in the CCW pump room is no longer considered necessary because the licensee has performed an assessment which confirms that the pumps will operate satisfactorily upon loss of ventilation. The remaining action relates to compensatory actions that would be necessary to prevent damage associated with the spurious opening of the PORV, letdown valves and the RCS sample valves due to a fire in the control room or cable spreading room. Based on an internal analysis performed by the licensee, the required compensatory actions include establishing auxiliary feedwater and RCS makeup within 25 minutes, and isolating the high-low pressure interface valves cited above within 30 minutes. These actions would be taken outside of the fire area. The licensee stated that, based on a plant walkdown of the shutdown procedures by plant operators, these actions can be accomplished within 15 minutes and 20 minutes, respectively. The staff has reviewed the prior information submitted by the licensee on this issue as well as additional information supplied by the licensee during the April and May 1990 Appendix R audit inspections. The staff's review of this matter is contained in Inspection Report No. 50-346/90007.

Associated Circuits Analysis

Section III.G of Appendix R to 10 CFR Part 50 requires that fire protection features be provided for associated non-safety circuits whose damage by fire could prevent operation of shutdown systems or cause maloperation due to hot shorts, open circuits, or shorts to ground. Three categories of associated circuits are of concern to the staff. These categories are: (1) common power source; (2) common enclosure; and (3) spurious operation.

The licensee provided a summary of the methodology used to evaluate and protect such circuits in the CAR and in the FAOR with supplemental information supplied in its letters dated May 27, 1987; January 6 and May 23, 1988; October 11, 1989; and May 10, 1990. As noted previously, this documentation is now contained in Revision 12 of the FHAR.

The licensee's Common Power Source Analysis was based on a review of the circuit interrupting device coordination and selective tripping characteristics of electrical distribution system power sources which feed loads required for safe shutdown. The primary object of this review was to ensure that an adequate level of protection was provided for power sources relied on to achieve post-fire shutdown, as required by NRC criteria and supplemented by NRC guidelines.

The licensee's associated circuit analysis identifies all power sources which supply power to components required for safe shutdown. If a power source is required to remain operable, then the associated circuits which share this common supply were also evaluated. The licensee then confirmed that an adequate level of protection was provided for all required power sources. The method of protection provided depends on the specific power source being evaluated. An acceptable level of protection may be provided through adequate coordination of breakers and fuses or, for those power sources lacking such coordination, demonstration of acceptable protection through a detailed evaluation of the potential effect of a postulated fire on the connected circuits of the power source for each fire area of concern. This evaluation includes an analysis of the specific cable routing, by fire area, of each potentially affected circuit and an appropriate documentation of justifications and/or corrective measures, such as manual operator actions.

The results of these analyses revealed that, except for the occurrence of multiple, high impedance ground faults, all circuits of concern are provided with an acceptable level of protection that is in accordance with the criteria in Generic Letter 81-12. With regard to the protection provided for multiple, fire induced, high impedance faults, the licensee has performed an analysis to evaluate the impact of such faults on the required 4160V AC, 480V AC, 250V DC, 125V DC, and 120/240V AC distribution systems. This analysis is currently under review by NRR.

Based on the results of the licensee's analysis, proposed modifications, and safe shutdown procedures, the staff concludes that the licensee's technical approach to associated circuits by common power supply is acceptable. In addition, the licensee's fuse/breaker coordination studies and methods of protection provided for single low impedance type faults of the common power source concern were reviewed during the April and May 1990 Appendix R audit inspections and found to be acceptable.

The licensee's Common Enclosure Analysis was based on a review of the electrical distribution system to verify that a circuit intercepting device has been provided for circuits routed within a common enclosure as defined in Generic Letter 81-12. In addition, the licensee verified, in Revision 12 to the FHAR that sufficient measures (e.g. fire barriers and barrier penetration seals) have been provided to prevent fire propagation into a

common enclosure. The licensee identified in this document typical common enclosures such as junction boxes, cabinets and panels which contain both safe shutdown and non-safe shutdown circuits and confirmed that a proper breaker or fuse is provided for the common enclosure circuits in a manner similar to that done for the common power supply associated circuits.

Finally, the licensee assessed in Revision 12 to the FHAR the adequacy of fire barriers and penetration sealants to prevent fire propagation. The results of the licensee's analyses confirms that there are no common enclosure associated circuits of concern. The licensee's detailed analyses of this issue was reviewed during the April and May 1990 Appendix R audit inspections.

The licensee's Spurious Signal Analysis was predicated on the circuit damage assumptions delineated in Generic letter 86-10. A systems engineering review was performed on plant systems and equipment to determine which of the components had the potential to defeat safety functions by their spurious operation. These components and their normal and unacceptable operating states are identified in Revision 12 to the FHAR. The components were assumed to have the potential to go to an unacceptable position for the purposes of selecting the spurious actuation components.

Spurious actuation components were included on the Safe Shutdown Components List in Revision 1 to the FAOR as part of the safe shutdown systems or supporting systems. This list is presently contained in Appendix A of Revision 12 to the FHAR. The spurious actuation components and their circuits were tabulated in the same computer data base listings as the safe shutdown systems. The computer data base was then sorted by fire area. The resulting information was utilized in the separation evaluation previously discussed which was performed in accordance with Section III.G of Appendix R to 10 CFR Part 50.

The elementary wiring diagrams for each component were analyzed in order to identify which circuits could potentially fail in such a way as to cause a spurious action of the component. For each conductor within a cable, the impact of a hot short, open circuit and short to ground was evaluated. The results of this evaluation was a list of potential nonconformances which were identified in Revision 1 to the FAOR and which are now in Revision 12 of the FHAR. Resolution of these nonconformances included the provision of fire protection features to prevent damage which would result in spurious signals. These features included plant modifications such as installing isolation switches to preclude spurious signals, and reliance on emergency procedures including racking out power to an affected component to compensate for a spurious signal that might occur.

During the review of the licensee's approach to the associated circuits issue, the staff expressed concern that the licensee's procedures may have been based on interrupting the offsite power supply to all essential and nonessential loads to compensate for fire damage. Shutdown capability would then be based solely on the on-site power supply. The staff viewed this approach as being nonconservative because the voluntary disablement of a source of power to a shutdown system that may not be damaged due to the fire is contrary to the defense-in-depth approach to fire protection in the

staff criteria which provides for use of any and all available means for achieving safe shutdown. In the event that the diesel generator would not start or would not continue to run after starting, power to safely shutdown the plant may be unavailable. The licensee subsequently revised its procedures for load shedding as discussed in its letter dated July 20, 1990 following a meeting with the staff on May 31, 1990. The staff concludes that this approach to voluntary loss of offsite power is acceptable.

VII. CONCLUSION

Based on the above review and evaluation of the licensee's fire protection program, and subject to the approved deviations and exemptions and the licensee's commitments to implement various additional fire protection measures during the seventh and eighth refueling outages, the staff concludes that the fire protection program at Davis-Besse conforms with the guidelines in Appendix A to the BTP, the requirements of Appendix R to 10 CFR Part 50 and the supplemental staff guidance on fire protection, and is acceptable.

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Date: May 30, 1991