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1.0 INTRODUCTION

1.1 Purpose of Review

This Technical Evaluation Report (TER) documents an independent review of Revisions 4 and 5 of the Updated Fire Hazards Analysis (UFHA) for the San Onofre Nuclear Generating Station, Units 1, 2, and 3 submitted by Southern California Edison Company, the licensee. The evaluation was performed:

1. To determine if the Revisions meet the guidance established by BTP CMEB 9.5-1, and
2. To verify that where the Applicant deviates from staff guidance, an equivalent level of fire protection is provided.

In addition, responses to open items identified in Revision 1 to the Safety Evaluation Report pertaining to review of the UFHA were evaluated. A response to these open items was requested by the NRC in a letter dated June 29, 1988. Also, issues identified by the Licensee in a letter dated November 21, 1988 are addressed.

1.2 Generic Background

General Design Criterion 3 (GDC 3), "Fire Protection," of Appendix A to 10CFR50 requires that structures, systems and components important to safety be designed and located to minimize, consistent with other safety requirements, the probability and effects of fires and explosions. Noncombustible and heat resistant materials are required to be used wherever practical. GDC 3 also requires that fire detection and suppression systems of appropriate capacity and capability be provided and designed to minimize the adverse effects of fires on structures, systems and components important to safety. Additionally, fire fighting systems should be designed to ensure that their failure, rupture or inadvertent operation does not significantly impair the safety capabilities of these structures, systems and components.

Either the staff guidance contained in Branch Technical Position (BTP) CMEB 9.5-1 or NUREG 0800, "Standard Review Plan," or the combination of staff guidance contained in Appendix A to BTP APCS 9.5-1 and the technical requirements set forth in Appendix R to 10CFR50 define the essential elements of an acceptable fire protection program at nuclear power plants for demonstrating compliance with GDC 3. The purpose of the fire protection program is to ensure the capability to shut down the reactor and to maintain it in a safe shutdown condition and to minimize radioactive releases to the environment in the event of a fire. The above guidance implements the philosophy of defense-in-depth protection against the hazards of fire and its associated effects on safety-related equipment.

Applicants must detail their program in the Final Safety Analysis Report (FSAR), including plant design features, organization, and administrative controls. The FSAR must include a fire hazards analysis (FHA), which describes plant design and equipment on an area-by-area basis. The FHA should identify fire area boundaries and demonstrate that a fire in any given area will not prevent the plant from safely shutting down. Where any plant design feature deviates from regulatory guidance, it must be identified and demonstrated that the deviation does not adversely affect plant safety.

1.3 Plant Specific Background

By letter dated August 25, 1988 Southern California Edison responded to open items resulting from the NRC review of the Updated Fire Hazards Analysis as documented in the June 29, 1988 letter from the NRC. The NRC identified five open items based on concerns related to the following:

1. The adequacy of "previously approved" fire barriers;
2. The adequacy of fire barrier penetration seals;
3. Potential deviations from "Nuclear Plant Fire Protection Functional Responsibilities, Administrative Controls and Quality Assurance";

4. The acceptability of power lockout devices;
5. The acceptability of potential additional deviations from BTP CMEB 9.5-1.

An additional concern raised by the NRC related to circuit interrupting devices was responded to separately by the licensee and is not evaluated in this report.

By letter dated September 2, 1988 Southern California Edison submitted Revision 4 to the UFHA. This revision incorporated plant modifications and changes in the safe shutdown compliance assessment. By letter dated November 21, 1988 the Licensee submitted several evaluation conducted in accordance with the guidance in Generic Letter 86-10 dealing with fire area boundaries. Also in this letter, the Licensee submitted a deviation request for the SONGS 2 yard area. In addition, the November 21, 1988 letter identified several clarifications in the fire protection program.

By letter dated February 15, 1989 the licensee submitted Revision 5 to the UFHA incorporating additional modifications made to the plant and the fire protection program.

This Technical Evaluation Report provides an evaluation of the UFHA Revisions 4 and 5, the responses to open items previously identified by the NRC, and the deviation request and 86-10 evaluations from the November 21, 1988 letter. During the course of the evaluation, a request for additional information was sent to the licensee on April 6, 1989. The licensee responded to this request by letter dated June 2, 1989. This evaluation includes information provided in that response.

2.0 EVALUATION

2.1 Previously Approved Fire Area Boundaries

During a December 1987 plant walkdown of Units 2 and 3, NRC Inspectors determined that some fire barriers which had previously been determined acceptable by the NRC, did not match their descriptions and therefore, may not be in compliance with the guidelines in STP CMEB 9.5-1. The licensee was requested to identify all such barriers and to provide justification why the barriers were still adequate.

By letter dated August 25, 1988 the licensee stated that fire barriers whose present configuration is not consistent with what is defined in the original Fire Hazards Analysis are no longer considered to be previously approved and have been evaluated in accordance with Generic Letter 86-10. The licensee did state that for some barriers previously identified in the FHA, only one side was originally considered to be a fire area. The Updated FHA may now identify both sides of that barrier as fire areas. The licensee states that if the barrier's rating still meets or exceeds the rating of what was originally depicted, the barrier is considered previously approved. An example of this would be a stairwell which was not originally shown as a fire area, however the stairwell walls were identified as a fire barrier. If the configuration of that barrier has not changed from what was originally identified, the NRC agrees that these barriers can be considered previously approved.

By letter dated November 21, 1988 the licensee provided a list of barriers for which it was determined there is a change in the rating of the barrier from that originally stated in the FHA. The licensee performed evaluations for these barriers and concluded that the barriers in question will still adequately prevent the propagation of fire between fire areas. The licensee included in the November letter, evaluations for those barriers which are credited for providing separation between redundant shutdown trains. These barriers were also previously identified in deviation requests. Enclosure 1 of the November letter provides a table which identifies the barriers in question; the deviation request in which the barriers were identified; and both the original and revised fire rating.

Also, a reference to the specific evaluation which provides justification for adequacy of the revised rating, is provided.

The evaluations provided in the November 21, 1988 letter were reviewed and found to provide adequate justification for the acceptability of the current ratings as stated in the table. Justifications provided by the licensee in the evaluations included review of combustible loadings within the fire areas, consideration for detection and suppression and review of the physical construction of the barriers including existing penetrations.

Based on the review of information provided by the licensee in their letters dated August 25 and November 21, 1988 the licensee has been found to adequately address the review of fire barriers not previously approved by the NRC and therefore this item is now closed.

2.2 Fire Barrier Penetration Seals

In the June 29, 1988 Safety Evaluation Report, the NRC stated that the licensee had been requested to provide information regarding the qualification of penetration seals in fire rated barriers. In response to this request, the licensee informed the NRC that a comprehensive evaluation was under way to revalidate seals in the plant. Pending resolution of this issue, the licensee was maintaining roving hourly fire watch patrols for areas where penetration seal qualification was in question.

By letter dated August 25, 1988 the licensee submitted a final report titled "Fire Area Boundary Penetration Seal Evaluation Program". This report was intended by the licensee to resolve all issues of concern related to penetration seal qualification. Prior to submission of this final report, the licensee met with the NRC on several occasions to discuss methodologies used in the evaluation.

The licensee's penetration seal program was developed to cover all aspects of the penetration seal program. The licensee's evaluation report provides information on seal design; construction, installation and maintenance of seals; and a review of installed seals including evaluations of those seals which did not appear to conform with tested details. The evaluation covered penetrations in barriers separating safe shutdown

components, barriers credited with meeting the guidelines of Appendix A to Branch Technical Position (BTP) 9.5-1 and internal conduit seals.

Phase 1 of the licensee's evaluation provided a review of penetration seal design. The plant has 31 specific seal drawing details. Documentation to evaluate these details include fire tests submitted by BISCO, the original seal vendor, and test procedures by other utilities. The licensee developed a list of parameters which would be used to evaluate the plants details against tested designs. These parameters are as follows:

- o Maximum allowable area
- o Seal materials
- o Seal depth
- o Annular gap dimensions
- o Symmetry of detail
- o Cable jacket material
- o Seal orientation
- o Cable fill of trays
- o Spacing, location and combination of penetrating items
- o Sleeved vs. unsleeved penetrations
- o Wall construction

This list was reviewed by the NRC prior to the licensee's evaluation and it was concurred that consideration of these parameters would cover the significant variables that could affect seal rating.

The licensee's evaluation methodology concludes that where it is determined that the aforementioned parameters, as identified on a plant detail, are represented adequately by one or more tests conducted in accordance with ASTM E-119, the seal design is considered rated equivalent to the tested detail. Where the parameters on the plant detail significantly differed from the tested details, a further evaluation was performed to assess the potential affect of that deviation on seal rating. The evaluation either determined that the deviation would not reduce the fire rating of the seal or that a potential reduction in seal rating may occur and therefore additional evaluation is necessary. When the rating of

the seal could not be determined or predicted, that particular seal design was labeled as "indeterminate" and required additional evaluation.

When a seal design differed from a tested detail, the design was reviewed by fire protection engineers to determine if that design detail could be used with certain restrictions which would ensure the seal would perform its intended function. These restrictions included limits on seal size; limits on gap dimension; restrictions on boot orientation; and restrictions on material used. This type of evaluation also considered where a particular seal was used and took into account location of safe shutdown components; combustible loading; detection and suppression in the area; and components or structures adjacent to the seal which would act as radiant shields.

Phase 2 of the program evaluation provided a review of construction, installation and maintenance of the seals. This review looked at original construction techniques and quality controls pertaining to seal selection and installation. Procedures for fabrication including material control were reviewed. This part of the evaluation also included a review of training records to assess the adequacy of training for installers and quality assurance reviewers. In addition, maintenance procedures for routine repair or replacement of seals were reviewed to ensure that seal integrity was not compromised from maintenance activities.

Phase 3 of the program included plant walkdowns to verify seal installation against seal details evaluated in phase 1. Phase 3 also included further evaluation for those seals which could not be verified as rated seals with earlier evaluations. After further evaluation, seals were either determined as "rated", "qualified" or "nonqualified". Rated seals were determined to be supported with documented test criteria. Qualified seals were determined to perform their intended function based on equivalency with test details taking into account the parameters mentioned earlier. Nonqualified seals could not be supported either by direct comparison to tested details or by engineering evaluation. This type of seal required corrective action.

Based on review of the penetration seal program, it is concluded that the licensee has performed a comprehensive review of penetration seals

within areas where a fire could affect plant safety. The licensee's program has considered, design, installation and maintenance of seals. The licensee's review also included personnel training, documentation and material control. There is reasonable assurance that the plant penetration program will ensure that installed seals will perform their intended function. Therefore the concern related to adequacy of penetration seals as identified by the NRC in the June 29, 1988 SER has been addressed and this issue is now closed.

2.3 Deviations from "Nuclear Plant Functional Responsibilities, Administrative Controls and Quality Assurance"

In the June 29, 1988 SER, deviations from the NRC guidance document "Nuclear plant Functional Responsibilities, Administrative Controls and Quality Assurance" issued on August 29, 1977 was left as an open item.

By letter dated August 25, 1988 the licensee identified deviations to the above stated NRC guidance and provided justification for the differences. The majority of the discrepancies identified were minor clarifications such as differences in personnel titles or management organization from that identified by the NRC. These clarifications were reviewed and were not found to provide a reduction in the effectiveness of the plant fire protection program. The remainder of the discrepancies involve items where the plant fire protection program has adequately addressed the issue but in a way which varies from the guidelines. For example, the guidelines state that pre-fire strategies should identify locked doors. However, the plant has chosen to address this in security procedures which require guards to assist the fire brigade in gaining access. This would be considered appropriate and meets the intent of gaining access to the fire location. All other clarifications have been reviewed and have been found acceptable. Therefore, the licensee has adequately identified and justified deviations from the aforementioned NRC guidance and this issue is considered closed.

2.4 Power Lockout Devices

The licensee's analysis of spurious operation of components as a result of fire necessitated that power be locked out to certain valves required by

BTP RSB 5-1, "Design Requirements of the Residual Heat Removal System", to be operable from the Control Room. An NRC evaluation included in the June 29, 1988 letter found this requirement to be acceptable from a fire protection standpoint, however, the licensee was required to submit a 10 CFR 50.59 review which considered compliance with BTP RSB 5-1.

Enclosure 4 of the licensee's letter dated June 29, 1988 included the requested 10 CFR 50.59 safety evaluation. This evaluation was reviewed by the NRC and adequately demonstrates the power lockout valve modifications are in compliance with BTP RSB 5-1. The 10 CFR 50.59 analysis addresses the safety impact on plant shutdown of these modifications. For the three systems affected (shutdown cooling, pressurizer auxiliary spray, and component cooling water crosstie), power lockout prevents spurious valve operation due to fire damage. When needed for long term cooling, acceptable manual operator action will restore power and allow valve operation and system operation. Therefore, based on the review of the licensee's analysis, this issue is considered closed.

2.5 Separation of Shutdown Components in the Yard Area

By letter dated November 21, 1988 the licensee requested a deviation from Appendix R to 10 CFR 50 Section III.G with respect to separation of redundant trains of safe shutdown cables in the yard area. The licensee identified that this exemption was the result of a review in conjunction with Revision 4 to the UFHA.

The yard area, designated as Fire Area 2-YD-30-200 is divided into two fire zones, 2-YD-30-200A and 2-YD-30-200B, which are the Unit 2 and Unit 3 yard areas respectively. The fire area incorporates all areas inside the protected area fence. The Unit 2 zone includes the area around the Unit 2 Diesel Generator Building, Auxiliary Feedwater Pump Room, water storage tanks, transformers and other support structures. The Unit 2 zone surrounds the Unit 3 Diesel Generator Building, Auxiliary Feedwater Pump Room, water storage tanks and Auxiliary Boiler. Combustibles within the fire area consist of oil, paints solvents, plastics and ordinary class A combustibles. Dikes are provided around the transformers and lube oil storage tanks. Manual fire fighting equipment is available to the full-time fire department

at the plant. The Auxiliary Boiler is provided with detection and automatic suppression.

This area does not meet the requirements of Section III.G of Appendix R because redundant safe shutdown cables are located in ductbanks within the fire area. Ductbank XV for Unit 3 contains both train A and train B cables. Of the remaining ductbanks, the closest A and B train raceways containing redundant shutdown cables are routed through manholes approximately 50 feet apart which are each located within buildings. There is no intervening combustibles between the two buildings. The closest A and X train raceways are also run through manholes approximately 50 feet apart. One of these manholes is located inside of a building. There are no intervening combustibles between the building and the manhole which is in the yard area. The closest B and X train manholes are 40 feet apart and are in a similar configuration. All of the manholes are fitted with tight metal covers which would prevent flammable liquids from leaking in. Ductbank XV previously mentioned contains redundant cables within the same manhole, however, the manhole is filled with sand which buries the cables to prevent fire propagation from one train to the other.

With the exception of Ductbank XV, all of the manholes which contain redundant cables for both Units 2 and 3 are adequately separated to prevent fire propagation from one manhole to the other. Since tight covers are provided it would not be probable for a flammable liquids fire to travel between and into redundant manholes. Although Ductbank XV contains redundant cables within the same manhole, it is filled with sand to prevent fire propagation. The sand provides reasonable assurance that a fire would not affect redundant trains of cable. Therefore, based on the physical separation, the limited combustibles in the yard area and the presence of sand in the Ductbank XV manhole, there is reasonable assurance that a fire would not compromise both trains of redundant cables needed for safe plant shutdown. This deviation, is therefore acceptable.

2.6 Revisions 4 and 5 to the UFHA

By letter dated September 2, 1988 the licensee submitted Revision 4 to the UFHA. This revision included modifications made to the plant fire protection program including a reassessment of compliance with Appendix R

to 10 CFR 50. This Revision also incorporated deviations to NRC criteria approved in the June 29, 1988 NRC Safety Evaluation. The revision also included proposed Fire Protection Technical Specifications and License Conditions for Units 2 and 3. Physical modifications to Unit 1 were also reflected.

This Revision has been reviewed to ensure that previous conclusions made by the NRC remain valid. Certain issues reflected in this Revision have been specifically evaluated in other sections of this report. Based on the review of the remaining changes, the plant modifications and programmatic changes reflected in Revision 4 do not adversely affect plant safety or impact on previous NRC conclusions. This evaluation, however, did not review the proposed technical specifications or license conditions which will be evaluated separately by the NRC. With this exception, the information provided in Revision 4 to the UFHA is found to be acceptable.

By letter dated February 15, 1989 the licensee submitted Revision 5 to the UFHA. This Revision reflected modifications implemented for Units 2 and 3 since the Unit 2, Cycle 4 refueling outage to comply with the requirements of Appendix R to 10 CFR 50. In addition, modifications to Unit 1 were reflected including incorporation of an approved exemption.

Review of Revision 5 to the UFHA was conducted in conjunction with review and evaluations of other issues discussed in this report. Based on this review, no changes in the fire protection program occurred with Revision 5 that would cause a reduction in plant safety or alter previous NRC conclusions associated with the fire protection program. Therefore, changes to the UFHA reflected in Revision 5 have been found acceptable.

2.7 Control Room Carpeting

Section c.7.b of BTP CMEB 9.5-1 states "there should be no carpeting in the control room". By letter dated April 6, 1989 the licensee was requested to justify the existence of carpeting in the control rooms. By letter dated June 2, 1989 the licensee provided a response to this request. The licensee stated that the combustible loading of the carpet was considered in the fire area analysis. In addition, the licensee stated that the carpeting has a flame spread and fuel contribution rating of less than 25.

The fire ratings of the carpet make it acceptable for use as an interior finish. In addition, the continuous presence of personnel in the Control Room would provide for quick detection and manual suppression of a fire should one occur. Therefore, the carpet can be considered an acceptable deviation from the requirements of BTP CMEB 9.5-1.

2.8 Seismic Water Supply

In the June 29, 1988 SER, the NRC evaluated and found acceptable, a proposal by the licensee to provide a connection to each unit's seismically qualified salt water cooling system to supply seawater to a pumper truck in lieu of the fresh water tankers currently used. In their letter of November 21, 1988 the licensee stated that technical difficulties will preclude implementation of the proposed modification, and that they will rely on the current use of fresh water tankers to provide a seismically qualified water supply. In addition, the licensee stated that an alternate tie down pad will be constructed for one tanker for instances where activities in one Fuel Handling Building truck bay require the tanker to be relocated. Since the use of fresh water tankers has been previously evaluated and found acceptable by the NRC, the failure to implement the proposed modification is acceptable.

2.9 Auxiliary Support Functions

The June 29, 1988 SER provided a discussion of the adequacy of post-fire HVAC capabilities within the plant. The evaluation based on the licensee's Appendix R analysis considered that manual actions would be required to maintain temperature levels for the Auxiliary Feedwater Pump Rooms following a fire. In their November 21, 1988 letter, the licensee stated their analysis had been revised and that manual actions would only be required for a fire in the pump rooms and the eight alternative shutdown areas. For all other fire areas, the licensee has determined that adequate electrical separation of the HVAC circuits exists. Although, this is different from what was evaluated by the NRC, it is considered to be an improvement and would not affect any conclusions previously made by the NRC. Therefore, this change in the Appendix R analysis is considered acceptable.

2.10 Deviations from BTP CMEB 9.5-1

The staff previously expressed concern that there may be deviations from BTP CMEB 9.5-1 that had not been identified and justified by the licensee. Consequently, a review of the licensee's fire protection submittal was made to identify any such deviations. A number of acceptable deviations have been identified or documented in the staff safety evaluations. On the basis that no additional unreviewed deviations exist, this issue is considered resolved.

3.0 CONCLUSIONS

Based on the evaluations discussed in this report, Revisions 4 and 5 to the UFHA have been found acceptable. In addition, the open issues from the June 29, 1989 SER which have been discussed in this report, have been adequately addressed by the licensee and are now resolved. Therefore, compensatory fire watch patrols which have been in-place pending resolution of open items may be suspended.