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ACCESSION NBR:8106190165 DOC.DATE: 81/06/15 NOTARIZED: NO DOCKET #
FACIL:50-361 San Onofre Nuclear Station, Unit 2, Southern Californ 05000361
50-362 San Onofre Nuclear Station, Unit 3, Southern Californ 05000362
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SUBJECT: Forwards revisions to fire hazards analysis,Section I & revised responses to NRC questions to clarify project fire protection provisions.

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JUN 22 1981

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June 15, 1981

Director, Office of Nuclear Reactor Regulation
Attention: Mr. Frank Miraglia, Branch Chief
Licensing Branch No. 3
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Gentlemen:

Subject: Docket Nos. 50-361 and 50-362
San Onofre Nuclear Generating Station
Units 2&3

Enclosed are sixty-three (63) copies of revisions made to Fire Hazards Analysis (FHA), Section I, and revised responses to NRC questions to provide clarification of the project fire protection provisions.

Direct distribution of these revisions will be made as part of the FSAR Amendment 25 distribution which will be in accordance with the service list provided by SCE's letter of May 21, 1981. An affidavit attesting to the fact that distribution has been completed will be provided within ten (10) days of docketing Amendment 25.

Please let me know if you have any questions or need any additional information.

Very truly yours,

K P Baskin

Enclosure

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standpipes from the normal non-Seismic Category I supply headers. New hose stations will be added in the electrical penetration areas and in the fuel handling building. The upgraded standpipes will be provided with valved hose connections to which a hose from a fire truck can be connected. The pump tank trucks will park on the access road around the power block, and the hose will be used to supply the standpipes. Other plant areas such as electrical tunnels, diesel generator building, auxiliary feed water pump, and safety equipment building will be provided by using hoses directly from the pump/tank trucks that are moved to the fire area. The above design changes will provide capability to fight a fire after a safe shutdown earthquake. 3

N. SINGLE FAILURE CRITERIA

A single failure in the fire suppression system will not impair both the primary and backup fire suppression capability. For example, redundant fire pumps with independent power supplies and controls are provided. Postulated fires or fire protection system failures are not considered concurrent with other plant accidents or the most severe natural phenomena. The effects of lightning strikes are included in the overall plant fire protection program.

Additional backup is provided from the San Onofre Unit 1 Fire Protection System, which is equipped with two 1,000 gal/min motor driven fire pumps, which take suction from a 3,000,000 gallon reservoir, through a normally closed isolation valve. The San Onofre 1 pumps and the San Onofre 2 and 3 pumps are powered from separate electrical supplies. The single line to containment is subject to single failure, but is built to a Category I level to minimize a failure.

O. SAFE SHUTDOWN ANALYSIS

Figures II-24 and II-25 are safe shutdown logic diagrams for a fire at San Onofre 2&3 Nuclear Plant. These figures identify those plant features necessary to achieve and maintain a safe plant shutdown in the event of a fire. An analysis of the plant has been conducted based upon these diagrams assuming a postulated exposure fire with a zone of influence requiring a minimum 20-foot clear air space spatial separation of redundant equipment, circuits, or components in all plant areas outside of containment. This analysis has identified where additional protection and/or separation is required to assure that the hot shutdown condition is reached during a fire using only existing hardware and no extraordinary operating action (i.e., the operator's response will consist of plant manipulations typical of those required for normal operation). Electrical components and valves are assumed to fail to their loss of power position if affected by the postulated fire. Manual actions necessary to take local control of normally automatically controlled systems such as auxiliary feedwater are assumed to be completed prior to being disabled by a fire (i.e. erratic operation of control systems was not assumed prior to operator action to assume local control). Spurious actuation of components was not specifically 3 7

analyzed; however, should spurious actuation occur, operator action can be taken to restore plant conditions. The analysis does not consider inside primary containment because transient fire loads in this area, when the plant is at power, are not credible, and fixed hazards which pose an exposure threat to equipment components or circuits required for safe shutdown (i.e., reactor coolant pumps) are provided with a reactor coolant pump lube oil collection system which prevents leaking oil from coming in contact with high temperature components, fixed automatic water suppression systems and automatic detection capability. See responses to questions FQ015.30, FQ015.38, and FQ015.56. Note that terms such as inadequate separation and unacceptable interaction when used in this discussion refer to the inability to achieve 20-foot spatial separation within a fire zone. These terms do not imply violation of separation as specified in the plant design criteria.

1. Hot Shutdown

   Each of the five conditions necessary to achieve hot shutdown are discussed separately. Refer to the five conditions which provide input into the AND block that leads to the hot shutdown condition on the shutdown logic diagram.

2. Reactor Coolant System Temperature Control

   This condition requires that Tc instrumentation, a means to relieve steam, and secondary side isolation be available.

   a. Secondary Side Pressure Control - The secondary safety valves, atmospheric dump valves, and secondary side isolation can satisfy this plant condition. The spring-loaded secondary safety valves used for short-term control are considered immune to fire damage. The atmospheric dump valves used for long-term control are adequately separated so that access to the valves for manual actuation can be assured during a fire. The redundant circuits for the steam generator pressure instrumentation were found to be adequately separated. A new instrumentation panel has been added to achieve the required separation.

      The main steam isolation valves are stored-energy, fail-closed valves which require both A and B control signals to remain in the open position. A postulated fire which would affect the control cables would cause the valves to shut, assuring this function. Hence, these control cables and those for the turbine stop and bypass isolation, were not evaluated.

      Analysis of the main feedwater isolation valves indicated that at least one of the two valves in each feedwater line could be shut or would fail shut for the postulated fire.

Each of the steam generator blowdown and sample lines contains fail closed blowdown isolation valve. The valve would fail in the desired, closed position if there was fire damage to the control cables; hence this feature is considered to be assured and was not evaluated.

b. Tc Instrumentation - The redundant Tc instruments were found to be inadequately separated. A new instrumentation panel was added to achieve the required separation.

c. Steam Generator Inventory Control - This plant condition requires an auxiliary or main feed pump capable of feeding any one steam generator, level control for the steam generator, and suction to the pump. The analysis identified areas where both trains of auxiliary feedwater cabling were affected. The B train cabling has been wrapped with 1-hour fire barrier insulating blanket material and transfer switches have been added to the switchgear rooms to provide isolation from the control room. Interactions also exist for the automatic control of the Steam Generator Level Control function. These interactions have been deemed acceptable because the control valves themselves are adequately separated and manual control is achievable. Unacceptable interactions were found to exist for the steam generator level signal which is necessary for both manual or automatic level control. A new instrumentation panel has been provided which provides steam generator level and pressure and from which communications to the operator at the auxiliary feedwater control valves will be available. Suction from the condensate storage tank is assured due to the tank being immune to fire damage. 3

d. Initial Reactivity Control - The Reactor Trip System which provides this condition is a fail-safe system which will respond to the postulated fire by causing the control rods to be inserted. Thus, no evaluation was considered necessary.

e. RCS Pressure Control - This condition requires pressurizer backup heaters, auxiliary spray, and pressurizer pressure instrumentation. The power cables outside containment for the pressurizer backup heaters were found to interact within 20 feet in the cable riser gallery. The B train power cable has been wrapped with a 1-hour fire retardant blanket material and a transfer switch added in the switchgear room. The pressurizer pressure instrumentation was found to interact within 20 feet of each other. A new instrumentation panel has been provided in the penetration area to address this concern. Auxiliary spray is a manual alignment and adequate separation of the charging pumps exist so this function is assured.

f. Reactor Coolant System Inventory Control - This condition requires that RCS letdown by controlled, that RCS makeup be provided, that reactor coolant pump seal integrity be assured and the pressurizer level instrumentation be available. These four conditions are discussed separately.

g. RCS Letdown Control - This condition can be satisfied by closure of any one of a number of letdown isolation valves in each of two series strings of valves. Since all of the valves involved are valves which would fail in the desired position should their control cable be damaged, these control circuits were not evaluated for separation.

h. RCS Makeup - This condition requires the availability of a charging pump, pump suction, and a flow path into the RCS. Of these, water, via Volume Control Tank Suction and Refueling Water Storage Tank Suction, or Boric Acid Makeup Tank Suction is assured since the tanks themselves perform only a passive function which would not be jeopardized by a fire, and manual handwheel operation of the RWST suction valves is acceptable.

3

Unacceptable interactions were found in the charging pump power cables, CCW pump power cables and charging pump HVAC power cables. The B train power cables for these components will be wrapped with a 1-hour fire retardant barrier material. Transfer switches for these components have been added to the switchgear room to provide isolation from the control room.

The redundant pressurizer pressure instrumentation was found to be inadequately separated. A new instrumentation panel has been added to achieve the required separation.

i. RCP Seal Integrity - Seal integrity can be maintained if either CCW is supplied to the reactor coolant pumps or if either of two seal bleed isolation valves are shut. Unacceptable interactions in the CCW system have been corrected by addition of a 1-hour fire retardant barrier material to the power cables. Transfer switches have been added to the switchgear rooms to provide isolation from the control room. Operation of the seal bleed isolation valves is assured since one is inside and one is outside containment with the outside valve being fail closed.

3. Cold Shutdown

Figure II-25 is the shutdown logic diagram for cold shutdown. It identifies two additional plant conditions, Long

Term Heat Removal and Long Term Reactivity Control, which must be established to place the plant in the cold shutdown condition. This section of the shutdown logic diagram has been analyzed to assure that all required plant conditions can be established within 72 hours of a postulated fire having a zone of influence requiring a minimum 20-foot separation (e.g., manual operator actuations to reposition valves using local handwheels was taken credit for in this portion of the analysis). 3 7

a. Long Term Heat Removal - This condition requires the Residual Heat Removal (RHR) system to be operable, wide range Tc instrumentation and pressurizer setpoint reset to be available, RCS pressure control and the ability to isolate or depressurize the safety injection tanks.

   Inadequate separation was found in the component cooling water, residual heat removal and salt water cooling pumps and their respective HVAC systems. B train power cable for the above pumps and HVAC units is being wrapped with a 1-hour barrier of fire retardant blanket material to achieve the desired separation. Transfer switches have been added to the switchgear rooms to provide isolation from the control room. Manual handwheel operation of all required valves for RHR alignment, auxiliary spray, and safety injection tank isolation or depressurization is acceptable with no further evaluation. RCS pressure control is assured by wrapping B train power cables to the pressurizer backup heaters with a 1-hour fire retardant blanket material and by providing a new independent instrument panel that will display pressurizer pressure. Wide range Tc will also be displayed on this panel. Pressurizer setpoint reset is mounted on the remote shutdown panel and will be protected with a transfer switch. 3

b. Long Term Reactivity Control - To establish an acceptable shutdown margin under cold conditions, boric acid must be charged into the reactor coolant system. This condition requires flow from the boric acid makeup tank through the charging pumps to the RCS. The flow path can be established by manual handwheel operation of the required valves. Inadequate separation of the redundant charging pumps and charging pump room HVAC units was found. A 1-hour rated fire retardant blanket material will be wrapped around the B train power to these components to achieve the desired separation. Transfer switches will be added to the switchgear room to provide separation from the control room.

P. COMMUNICATIONS

A 2 channel UHF radio is available for communication between all operating stations necessary for safe shutdown.

3 The UHF system provided for the fire brigade consists of portable units and repeating stations to ensure coverage. Repeating stations and associated cabling are not protected from fire exposure. However, PAX cables presently within 20 feet of the UHF cables are rerouted, 5 or are wrapped with two 1-inch thicknesses of fire retardant blanket, to obtain adequate separation for an exposure fire. The power supply is from the safety-related bus with provisions for trip in the event of an SIAS or EFAS signal.

Q. CONCLUSION

As a result of the analysis conducted in Part II of this report and summarized above, corrective measures such as fire barriers, transfer switches, and new instrument panels have been added to the San Onofre 2&3 design. These measures assure the ability to safely shutdown the plant and to achieve cold shutdown within 72 hours through the use of appropriate operator actions. Responses to NRC questions 015.1 through 015.44 provide a more detailed description of the protective features 3 added to the design.

The plant will reach safe shutdown because no one design basis fire will fail redundant systems or components necessary for safe shutdown. Each zone was considered with respect to the shutdown logic diagram and combinations of fire barriers, transfer switches, redundant instrumentation panels, and insulating blanket material wrap which will provide the proper fire protection. In addition, radiological consequences resulting from these fires are bounded by the accident, analyses presented in Chapter 15 of the San Onofre Units 2 and 3 FSAR and, consequently, cannot cause a release of radioactivity in excess of 10 CFR Part 100 limits.

BIBLIOGRAPHY

1. Design Guide KC-1.

Fire Protection for Thermal Power Stations by Bechtel Plant Facilities Staff, San Francisco Power Division for - Thermal Power Organization on 10-4-76.

2. Characteristic Temperature Curves for Various Fire Severities by - T. T. Lie, for Division of Building Research., National Research Council of Canada.

3. San Onofre 2 and 3 Final Safety Analysis Report.

4. The NFPA Fire Protection Handbook, Fourteenth Edition.

5. Uniform Building Code, 1976 Edition; International Conference of Building Officials.

Question FQ015.12

Page III-20. Redundant safe shutdown system cable separation in accordance with Regulatory Guide 1.75 is not considered adequate protection from the effects of exposure fires. It is our position that an automatic water suppression system be installed in all areas where redundant safe shutdown equipment or cable is not separated by 3 -hr. fire rated barriers. In addition, where such equipment or cable is separated by less than 20 feet, both trains of safe shutdown equipment or cable should be enclosed with at least a 30 minute fire rated barrier.

Response

Exposure fire barriers are provided for redundant safe shutdown cables separated by less than 20 feet as required with the exception of the containment cable spreading room, and control room. The analysis which was used to select cables requiring protection is discussed in section I, item O. 7

Where both A and B trains of safe shutdown systems are located in the same fire zone and are separated by less than 20 feet from each other (or other fire loads such as non-safety cable trays), one safe shutdown train will be wrapped with two 1-inch thicknesses of heat insulating blanket. This wrapping technique has been tested to ASTM E-119 temperature profiles to verify an approximate 1-hour fire rating. Power cables within an insulating blanket will be derated in accordance with the results of laboratory ampacity tests conducted by SCE to ensure acceptable cable temperatures. 3 5

In addition to the cable raceway wrapping, automatic deluge sprinkler systems are provided for each cable tray in cable riser galleries, cable tunnels and the cable spreading rooms. The sprinklers are activated by either ceiling mounted heat detectors or local pull stations. Products-of combustion detectors are also installed in these areas to provide early warning of fires to the control room.

Exposure fire barriers are not required in the containment, cable spreading room or control room. Within the containment, the separation of cabling trains, administrative controls, control of flammable material and concern regarding debris from heat insulating blankets are discussed in the response to NRC Question FQ015.38.a. Heat insulating blanket wrapping of tray and conduit within the cable spreading room and control room is not necessary because of the remote safe shutdown capability described in the response to NRC Question FQ015.34.b. This safe shutdown capability allows the plant to be put in a safe shutdown condition after loss of either the cable spreading room or control room. 3

Reference

See revised FHA section III, table III-1, item D.1.(a)(2), and section I, item O. 7

Question FQ015.25

Pages III-43, 44, Item 2. Control Room.

a. It is our position that the walls separating the control room from the cable risers be upgraded to provide a 3 hr. fire rated barrier. Describe how you will comply with this position.

b. It is our position that other rooms in the control room area which are not separated from the control room by 3 hr. fire barriers be separated by walls extending from floor slab to floor slab with a minimum 1 hr. fire resistance rating, and all such rooms should be provided with an automatic extinguishing system. Describe how you will comply with this position.

c. It is our position that fire detection capability be provided within the cabinets and consoles in the control room.

Response

a. The walls separating the control room from the cable risers provide a 2-hour fire rated barrier. This is considered sufficient due to the following:
   (1) the control room is normally occupied making the early detection and suppression of a fire probable.
   (2) Remote shutdown capability is being provided which is independent of the control room.
   (3) Where redundant cable required for safe shutdown is separated by less than 20 feet, one train of cable is being enclosed within a fire barrier with approximately 1-hour rating.
   (4) Water type fire extinguishers are being located in strategic locations throughout the control room.

   Assumptions used to select circuits requiring protection or isolation are described in section I, item O. 7

b. The control room habitability area consists of all areas shown on figure II-6 of the Fire Hazards Analysis with the exception of Zone 29, the cable riser galleries, which have been addressed in the response to question FQ015.25a. Within the control room area, rooms with any significant fire loadings are the computer rooms, which have their own independent halon fire suppression systems, and the fan rooms, containing charcoal filters, which are equipped with their own independent automatic deluge systems. Other rooms within the control room area are normally occupied and have negligible fire loadings. The wall separating the fan room from other rooms in the control room area extend from floor slab to floor slab and have a 2-hour fire barrier rating. Additional hand held water extinguishers 3 3

will be provided at strategic locations throughout the control room area. In addition, remote shutdown capability, independent of the control room area, will be provided. With the above provisions, San Onofre 2 & 3 meets the intent of this requirement.

c. Product-of-combustion fire detectors are provided in Class 1E control room cabinets consoles, and panels, essential to safe shutdown, that contain more than one redundant train and are not separated by metal barriers between division (metal barriers to provide individual compartments for each train).

The panels include the main control boards, mimic bus and NSSS interface cabinets 2 and 3L-188.

Reference

a. Refer to Fire Hazards Analysis section III, table III-1, item F.2.

3 b. Refer to Fire Hazards Analysis section III, table III-1, item F.2.

c. See revised Fire Hazards Analysis section III, table III-1, item F.2.

7 d. See revised Fire Hazards Analysis section I, item O.

Question FQ015.26

Pages III-45 through 47, Item 3. Cable Spreading Room.

a. It is our position that the 1 and 2 hr. fire barriers (including floor and ceiling) presently enclosing and separating the cable spreading rooms be upgraded to provide at least a 3 hr. fire rated barrier enclosing each cable spreading room. Describe how you will meet this position.

b. Page III-46; item 3.6.2. Redundant safe shutdown system cable separation in accordance with Regulatory Guide 1.75 is not considered adequate protection from the effects of exposure fires. It is our position that an automatic water suppression system be installed in all areas where redundant safe shutdown equipment or cable is not separated by 3-hr. fire rated barriers. In addition, where such equipment or cable is separated by less than 20 feet, both trains of safe shutdown equipment or cable should be enclosed with at least a 30-minute fire rated barrier.

Response

a. The East wall of the cable spreading rooms is a 3-hour fire rated barrier. The North and South walls, the wall between Units 2 and 3 cable spreading rooms, and the walls between the cable spreading rooms and the stairwells are 2-hour fire rated barriers. The walls between the cable spreading room and the relay room and corridor are 2-hour fire rated barriers. All doors installed in the 2- and 3-hour fire rated barriers have ratings consistent with or in excess of, that of the barrier. No safety-related equipment and/or cabling is in the relay room. Remote shutdown capability is being provided which is independent of the cable spreading rooms (see section I, item O). In addition to the above, a review of the fire loadings in this area indicates that the fire loadings will be less than the fire barrier ratings of the existing walls. Due to the above, the present construction is considered adequate and no upgrading of the cable spreading room walls is planned. 3 4 7 3

b. Refer to the response to NRC question FQ015.12 and revised fire hazards analysis section I, item O. 7

Reference

a. Refer to Fire Hazards Analysis section III, table III-1, item F.3.

b. Refer to NRC question FQ015.12.

7 c. Refer to fire hazards analysis section I, item O.

Question FQ015.30

Two Steam Generator Rooms - Zone 1. Consider an oil fire from a rupture in the reactor coolant pump oil lines will affect the other reactor coolant pumps or other safety-related equipment. Consider the floor openings. Install curbs at the 9'-0" elevation, and an oil containment and collection system.

Response

An oil fire from a rupture in a reactor coolant pump oil line would be limited to an area beneath the affected pump by slope of the floor and design of the pump compartment. The oil spill and fire extinguishing water would flow away from the pump, into the normal equipment and floor drain system via drains located in each pump compartment, and finally into the normal containment sump. In addition, the drain lines located in the compartments of the pumps serving steam generator No. 1 (E088) and those serving steam generator No. 2 (E089) do not combine except in the sump. This arrangement precludes a fire from propagating through the drain system from one set of reactor coolant pumps to the other set.

In conclusion, the present design is capable of containing and collecting oil from a reactor coolant pump in such a manner that it will not affect the other reactor coolant pumps and/or the minimum essential equipment to safely shutdown the reactor. This arrangement makes it unnecessary to install additional curbs and an oil containment and collection system for the reactor coolant pumps. However, in response to NRC Question 015.56, an engineered oil containment and collection system will be installed. 7

Reference

Refer to section II, zone 1, (containment-combustible oil area -two steam generator rooms), part 11 of the Fire Hazards Analysis. No FSAR or Fire Hazards Analysis changes were made. 3

See response to NRC Question 015.56. 7

Question FQ015.34

a. Verify that procedures necessary to bring the reactor(s) to a cold shutdown are available if a fire were to cause evacuation of the control room or were to destroy all cable and equipment in any of the following areas:

(1) Control Room

(2) Cable Spreading Room

(3) Cable Riser Galleries

(4) Cable Tunnels

(5) Any other areas containing redundant safe shutdown equipment or cables/

Consider the number of personnel required and available at projected minimum staffing periods to provide needed shutdown operations. Describe the provisions that have been made for emergency lighting at any remote areas required for safe shutdown operations, and how would communications be established between these areas, as well as other vital operations areas (i.e., fire brigade)?

b. Verify that all control functions from the remote shutdown panels are electrically independent of any circuits in the affected areas, including power supplies.

Response

a. Refer to the response to NRC Question FQ015.44.

b. To provide remote safe shutdown capability that is electrically and physically independent of the control room and cable spreading room, isolation switches and/or relays to electrically isolate shutdown equipment controls on the remote shutdown panel from circuits in the cable spreading and control room will be provided. The analysis performed and assumptions made to define the circuits requiring protection are provided in FHA section I, item O. A new safety-related (Seismic I) switch/relay panel will be installed in the load group A and load group B switchgear rooms which are separated by 2-hour fire walls. 7

All control and power circuits required for safe shutdown during or after operation of the transfer switches and/or relays will be identified and routed to ensure electrical and physical independence from the control room and cable spreading room.

Process instrumentation cabinets for processing essential instrumentation signals are located only in the control room; therefore, transfer switches will not provide the desired separation. Therefore,

5 a new non-safety related (Seismic III) instrumentation panel will be provided in the electrical penetration area with self contained progress instrumentation utilizing existing non-safety related transmitters which are isolated from existing instrumentation by means of transfer switches. Meters are provided on this panel to indicate steam generator pressure and level, pressurizer pressure and level and reactor coolant hot and cold leg temperatures.

Reference

3 a. Refer to NRC Question FQ015.44.

7 b. Refer to FHA section I, item O.

Question FQ015.56

It is our position that you provide an engineered oil containment and collection system for the reactor coolant pumps to protect against a pressurized oil spray igniting and affecting other safety related equipment or pumps. The installation must satisfy Reg. Guide 1.29, paragraph C.2. Reference Q015.30.

Response

5 7 An engineered oil containment and collection system for the reactor coolant pumps will be installed. The installation will satisfy Regulatory Guide 1.29, paragraph C.2. The system will be designed to ensure that during the safe shutdown earthquake (SSE) it will not structurally fail and unacceptably interact with safety related structures, systems and components.

Reference

None.