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ACCESSION NBR: 8611050394 DOC. DATE: 86/10/31 NOTARIZED: NO DOCKET #
FACIL: 50-361 San Onofre Nuclear Station, Unit 2, Southern Californ 05000361
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SUBJECT: Responds to Generic Ltrs 83-10a & 86-06 & TMI Action Item II.K.3.5, "Automatic Trip of Reactor Coolant Pumps." Encl 1 provides info prepared in accordance w/ Section IV & App A of SER as identified in Generic Ltr 86-06.

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October 31, 1986

Director, Office of Nuclear Reactor Regulation
Attention: Mr. George W. Knighton, Director
PWR Project Directorate No. 7
Division of PWR Licensing - B
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 and 3

NRC Generic Letter 83-10a requested that licensees provide justification for Reactor Coolant Pump (RCP) operations during transients and accidents either on an individual utility basis or by reference to a generic CE Owners Group (CEOG) submittal. By letter dated May 31, 1983, SCE indicated that San Onofre Units 2 and 3 would operate RCP's consistent with the CEOG "trip two, leave two" strategy. A description of this strategy was submitted to the NRC on July 14, 1983.

NRC Generic Letter 86-06 endorsed the generic information provided by the CEOG in support of this strategy. It further requested information regarding the implementation of TMI Action II.K.3.5 "Automatic Trip of Reactor Coolant Pumps" and the schedule for providing this information to the NRC. SCE subsequently informed the NRC on July 14, 1986 that the automatic RCP trip information will be made available on October 31, 1986.

Enclosure I provides information in response to this specific request. It is prepared in accordance with Section IV and Appendix A of the Safety Evaluation of the aforementioned "trip two, leave two" strategy identified in Generic Letter 86-06. SCE believes that the submittal of this requested information will complete the implementation requirements of the RCP trip criterion.

If you have any questions, please contact me.

Very truly yours,

M O Medford

cc: Harry Rood, NRC Project Manager
J. B. Martin, Regional Administrator, Region V
F. R. Huey, USNRC Senior Resident Inspector

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ENCLOSURE I

SCE RESPONSE TO GENERIC LETTER 86-06
IMPLEMENTATION REQUIREMENTS

Question 1

Identify the instrumentation to be used to determine the RCP trip setpoints, including the degree of redundancy of each parameter signal needed for the criteria chosen.

Response

SONGS 2&3 Emergency Operating Instructions (EOIs) require at least two channels of instrumentation be operational to provide an adequate reading substantiated with an independent verification. Identification of the instrumentation for the RCP trip setpoints is discussed below:

A. For tripping of the first two RCPs in opposite loops, the following instrumentation is used to determine the RCP pressure setpoint at 1430 psia:

Pressurizer Pressure Transducer

PT-0102-1,2,3 and 4;
0-3000 psia; Quality Class 2; Environmentally Qualified

SONGS 2&3 Technical Specifications require that at least three of them must be operable. Hence, this parameter can be monitored at all times with a sufficient degree of redundancy.

B. For determination of LOCA or non-LOCA events in order to conclude whether or not the remaining two RCPs be tripped, the following instrumentation is used:

1. Containment Radiation - Setpoint of 10R/hr.

High Range Containment Radiation Monitor

RE-7820-1;
1 to 10E+8 R/hr; Quality Class 2; Environmentally Qualified

RE-7820-2;
1 to 10E+8 R/hr; Quality Class 2; Environmentally Qualified

Backup

RE-7856-1; 10E-1 to 10E5 mR/hr; Quality Class 2

RE-7857-2; 10E-1 to 10E5 mR/hr; Quality Class 2

In addition, there exist process and effluent monitors that detect Containment Radiation.

SONGS 2&3 Technical Specifications mandate the operability of both area monitors simultaneously. In case one of them is not operational, a preplanned alternate method of monitoring Containment Radiation with the aid of other backup instruments can be initiated per Technical Specification Action Statements. These provisions provide the degree of redundancy needed for this parameter.

2. Subcooling Margin Monitor (SMM) - Subcooling <20^{o}F

Preferred

RCS Subcooling Margin available on page 611 of the Qualified Safety Parameter Display System (QSPDS) Menu*; Quality Class 2

Backup

RCS Subcooling Margin available on page 311 of the Critical Function Monitoring System (CFMS) Menu*; Quality Class 3

*Both QSPDS and CFMS share the same source of sensors.

3. Secondary Side Radiation - Setpoint Low 1mR/hr
Setpoint High 1R/hr

Main Steam Line Area Monitor

RE-7874A1, B1; Low Range, 10E-1 to 10E+4 mR/hr
Quality Class 2

RE-7875A1, B1; High Range, 10E-1 to 10E+4 R/hr
Quality Class 2

Backup

In addition, there exists process and effluent monitors that detect Secondary Side Radiation.

SONGS 2&3 Technical Specifications require that both low and high range area monitors for at least one steam line (A or B) must be operable. Again a preplanned alternate method of monitoring Secondary Side Radiation on the basis of other backup instruments can be initiated per Technical Specification Action Statements. Thus, it is possible to maintain the degree of redundancy for this parameter without any compromise.

C. Further decision for tripping the remaining two RCPs for non-LOCA events is based on the following instrumentation:

1. NPSH requirement for each RCP - Compare P/T curve in Emergency Procedure Technical Guidelines (EPTG) section.

2. Motor current - Verify RCP motor ammeters to be greater than 200 amps and not fluctuating greater than 400 amps.

3. RCP seal cooling water - Setpoint 400-500 gpm

   FIT 917; FIT 9130; FIT 9219;
   0-600 gpm; Quality Class 2

4. Control bleed-off flow - Setpoint of Low or Zero

   FI 150; FI 160; FI 170; FI 180;
   0-3.5 gpm; Quality Class 2

Question 2

Identify the instrumentation uncertainties for both normal and adverse containment conditions. Describe the basis for the selection of the adverse containment parameters. Address, as appropriate, local conditions such as fluid jets or pipe whip which might influence the instrumentation reliability.

Response

There are no vendor supplied instrumentation uncertainties for both normal and adverse containment conditions. However, it is feasible to compensate for uncertainties with some adequate conservatism used in the generic analyses of the Trip 2/Leave 2 strategy reported in CEN-268 since the preferred instruments used for tripping in Question 1 are highly qualified and reliable to provide the required information for operator actions. The instruments meet the applicable codes and standards consistent with the quality of the instrument as defined in the FSAR Sections 3.2 and 7.5. The listing shown in Question 1 also denotes the Quality Class of the instruments. Quality Class 1 and 2 instruments are 1E and safety related. In addition to the preferred instruments which are channelized and redundant, other instruments are available to measure the desired parameter as listed in Question 1. The instruments, which are used in a harsh environment, are environmentally qualified and are part of the SCE EQ Program.

The instrument characteristics of Quality Class 2, Safety Related, and Environmentally Qualified assures that the instruments will properly function under normal and the most adverse containment conditions as outlined in the SCE EQ Program.

SCE has not reviewed local conditions such as fluid jets or pipe whip which might influence the instrumentation reliability.

Question 3

In addressing the selection of the criterion, consideration of uncertainties associated with the CEOG supplied analyses values must be provided. These uncertainties include both uncertainties in the computer program results and uncertainties resulting from plant specific features not representative of the CEOG generic data group.

Response

The selection of the RCP trip criterion employs the plant specific data to SONGS 2 and 3. The selection described below has taken into account the uncertainties associated with the CEOG supplied analysis and is developed by the CE analysis. The instrumentation setpoint also accounts for the manufacturer's recommendations and specifications.

A. The first tier of the RCP operating strategy calls for tripping of the first two RCPs in opposite loops when the RCP pressure decreases below a certain setpoint.

All LOCA and non-LOCA events will result in RCS depressurization. Large break LOCAs will undergo a rapid and drastic RCS depressurization at or below 300 psia. Small break LOCAs in the range of concern for reactor coolant operation will result in a depressurization below 1361 psia. LOCAs which are smaller than this range of concern and many non-LOCA events (steam line breaks and SG tube rupture) will not result in depressurization below 1361 psia. Unless the rate of energy removal from the RCS is quite high, most transients will have a tendency to plateau in pressure at or above RCS saturation conditions which are somewhat higher than steam generator saturation conditions. Best estimate analysis has shown this pressure to be 1361 psia for 3410 MWt plants (CEN-268). The wide range pressurizer pressure instruments, in a non-degraded containment environment, have an estimated instrument loop accuracy of approximately $\pm$75 psi which is a differential pressure not affected by the unit (psia or psig) used. The resultant depressurization setpoint can then be chosen at 1361 psia + 75 psi or approximately 1430 psia. A non-degraded containment environment instrument loop accuracy was chosen because it is not anticipated that the instrument accuracy will be adversely affected during the first few minutes of an accident when the decision to trip the RCP would be made.

The referenced uncertainty of $\pm$75 psi is applicable to the preferred pressurizer pressure sensors shown in Response A of Question 1 and is plant specific to SONGS 2 and 3. This uncertainty value is comparable with but not representative of the CEOG generic data reported in CEN-268. Since the

nominal RCS pressure setpoint of 1361 psia for tripping the first two RCPs in opposite loops is based on the conservative best estimate analyses, it reflects the maximum uncertainties in various assumptions used to obtain the result. Thus, it is conservative to include this uncertainty in the computer program results in the selection of the RCP trip criterion.

B. The second tier of the RCP operating strategy calls for tripping of the remaining two RCPs on the basis of various combinations of plant specific criteria similar to those discussed in Section 4 of CEN-268. Responses B and C of Question 1 identifies those instrumentations. The selection of the trip criterion is further discussed in the following:

1. The determination of LOCA or non-LOCA events is mainly based on the RCS subcooling. The loss of RCS subcooling in both coolant loops is a prime indication of a LOCA event. This event would be further confirmed by the actuation of the containment radiation alarm without a concurrent actuation of any radiation alarms in the secondary cooling system. Thus, the remaining two RCPs will be tripped when the RCS subcooling goes below $20^{o}F$ and containment radiation goes above 10 R/hr when there is no detectable level of radiation in the SG system.

   As with the RCS pressure setpoint, an estimate of instrumentation errors must be factored into the selection of the subcooling setpoint. The $20^{o}F$ subcooling limit accounts for uncertainties associated with the use of the RCS subcooled margin monitor (SMM) which is one of the three components in QSPDS. This particular SMM for the RCS employs the RCS temperature and pressure inputs in the calculation of the subcooled margin. The temperature inputs are obtained from the resistance thermocouple detector (RTD) readings in one hot leg and two cold legs. The accuracy of these RTDs is $\pm$ 1% in the range of $0-710^{o}F$. This is equivalent to $\pm 7\ ^{o}F$ approximately in uncertainties. However, the Subcooled Margin calculations for the RCS are based on a conservative factor of $\pm\ 15^{o}F$ for temperature and $\pm$ 75 psi for the pressurizer pressure.

   The containment area radiation is measured by using the monitors installed to comply with NUREG-0737, Section II.F.1. These monitors are qualified to function in an accident environment. Since the instrument utilizes a log scale to cover the large range, a reasonable setting was determined in the second decade. This setting accounts for the operator's ability to easily detect the pointer setting and the instruments capacity to record the 10 R/hr quantity accurately. This setpoint value is chosen in compliance with SONGS 2&3 Technical Specification 3/4.3.3.

The SG secondary side is monitored by the radiation monitors on the main steam lines. Two monitors per steam line include a high and low scale. These sensors are not required to be safety grade, however, they are Quality Class 2. The settings account for the operator's ability to easily detect the pointer setting and the instrument's capacity to record the quantity accurately. The alarm/trip setpoints are specified in SONGS 2&3 Technical Specification 3/4.3.3 and are set at 1 mR/hr (low) and 1 R/hr (high), respectively.

2. For non-LOCA events associated with the steam line breaks, steam generator tube ruptures, and standard post trip actions, the remaining two RCPs will continue in operation to provide forced circulation during recovery. However, they will be tripped to prevent excessive uncovery of the reactor core when any of the following conditions is detected:

   a. NPSH requirements for the RCPs are not met.

   b. Motor running current is low or fluctuating abnormally.

   c. RCP seal cooling water is inadequate.

   d. Control bleed-off to the running RCPs is low or stopped.

   As identified in Response C of Question 1, the setpoint determination and action requirement in the selection of these conditions do not account for any instrumentation uncertainties.

Question 4

Identify all plant procedures (except for those concerning normal operations such as normal cooldown) which require RCP trip guidelines. Reference to the CEOG EPGs is acceptable if endorsed by the licensee. Include training and procedures which provide direction for use of individual steam generators with and without operating RCPs.

Response

SCE endorses the CEOG EPGs and proceeds one step further between the EPGs and the EOIs. Site specific EPGs, named the Emergency Procedures Technical Guidelines (EPTGs), were written for SONGS 2 and 3 with CE input. The Trip 2/Leave 2 strategy has been incorporated into the EPTGs. This strategy has been incorporated specifically in the Standard Post-Trip Actions, LOCA Guideline, SLB Guideline, and Functional Recovery Guideline. The strategy is not applicable to the Reactor Recovery Trip Guideline, Loss of Forced Circulation Guideline, or the Loss of Feedwater Guideline. The development of the EOIs from EPTGs are addressed in a SONGS Nuclear Training Department Lesson Plan which is presented as a part of the operator's initial licensing training. All SONGS EOIs are covered extensively in the classroom and during the simulator training, and practiced by San Onofre Operations Department personnel prior to and following NRC licensing.

Prior to the revision of the CEOG EPGs which provided the Trip 2/Leave 2 strategy, the EPGs assume all RCPs were tripped in compliance with FSAR analyses. However, it is believed that the current Trip 2/Leave 2 strategy will provide the most effective method of plant cooldown during those specific emergency conditions discussed in Question 3 even though plant operations are bounded by FSAR analyses.