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Portland General Electric Company
Trojan Nuclear Plant
71760 Columbia River Hwy.
Rainier, Oregon 97048
(503) 556-3713

WRR-159-90
November 30, 1990

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington DC 20555

Gentlemen:

Licensee Event Report No. 90-22, Revision 1 is attached. This report supplements an event in which penetration fire barriers were determined to have been non-functional for an extended time period.

Sincerely,

W. R. Robinson
General Manager
Trojan Nuclear Plant

c: Mr. John B. Martin
Regional Administrator, Region V
U.S. Nuclear Regulatory Commission

Mr. David Stewart-Smith
State of Oregon
Department of Energy

Mr. R. C. Barr
USNRC Resident Inspector
Trojan Nuclear Plant

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LICENSEE EVENT REPORT (LER)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 90.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (F-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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TITLE (4)
Degraded Fire Penetration Seals As a Result of Inadequate Construction Technique

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)		
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES		DOCKET NUMBER(S)
05	22	90	90	02	2	01	11	30	90		050000
											050000

OPERATING MODE (9) 5

POWER LEVEL (10) 0.00

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 5. (Check one or more of the following) (11)

20.402(b)	20.406(e)	50.73(a)(2)(iv)	73.71(b)
20.406(a)(1)(ii)	50.36(a)(1)	50.73(a)(2)(v)	73.71(c)
20.406(a)(1)(B)	50.36(a)(2)	50.73(a)(2)(vi)	<input checked="" type="checkbox"/> OTHER (Specify in Abstract below and in Text, NRC Form 366A)
20.406(a)(1)(B)	<input checked="" type="checkbox"/> 50.73(a)(2)(i)	50.73(a)(2)(vii)(A)	Special Report
20.406(a)(1)(iv)	50.73(a)(2)(B)	50.73(a)(2)(vii)(B)	
20.406(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(i)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
John D. Guberski, Compliance Engineer	503-556-5523

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRCDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRCDS

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If var. complete EXPECTED SUBMISSION DATE) NO

EXPECTED SUBMISSION DATE (15)

MONTH	DAY	YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On May 22, 1990, the Plant was in Mode 5 (Cold Shutdown) for the 1990 refueling outage. The 18-month interval surveillance, required by Trojan Technical Specification (TTS) 3/4.7.9, "Penetration Fire Barriers", identified four penetration fire seals with gaps, tears, or splits visible in the surface of the silicone foam sealant material that did not meet inspection criteria and were repaired. An evaluation determined, on June 15, 1990, that these four penetration fire seals were non-functional, and that 39 other penetration fire seals had a similar configuration. Twenty-seven out of the 39 failed to meet the inspection criteria and were repaired. Follow-up destructive examination of three seals, in November 1990, found significant splits in the interior of one seal. This seal will be restored by December 14, 1990. Evaluation of the destructive examination data determined that 17 similar seals should be considered non-functional. A schedule for resolution of the problems with these 17 penetration fire seals will be developed by February 28, 1991. The types of problems found are those described in Nuclear Regulatory Commission Information Notice 88-56: Potential Problems With Silicone Fire Barrier Penetration Seals. The probable cause of the voids, gaps, and splits was a lack of proper installation techniques and inspection requirements during original construction of the penetration fire seals. This report also fulfills the requirement to report a penetration fire barrier that is non-functional for more than seven days.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (F-830), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20585, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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TEXT (If more space is required, use additional NRC Form 388A's) (17)

DESCRIPTION OF OCCURRENCE

On May 22, 1990, the Plant was in Mode 5 (Cold Shutdown) for the 1990 refueling outage. The 18-month inspection of 3-hour fire-rated barriers required by Trojan Technical Specification (TTS) 3/4.7.9, "Penetration Fire Barriers", was in progress. During the course of the inspection, four silicone foam-type penetration fire seals were found to have voids, gaps, or splits in the foam. These problems were identified in seals for large blockouts in walls. Two of these four penetration fire seals had permanent damming boards in place. Damming boards are used in the construction of silicone foam-type penetration fire seals, and in some cases the damming material forms part of the 3-hour fire-rated barrier. The types of problems found are those described in Nuclear Regulatory Commission (NRC) Information Notice (IN) 88-56: Potential Problems With Silicone Fire Barrier Penetration Seals. IN 88-56 discusses that the lack of a visual inspection during seal construction could result in voids formed by gas pockets, or lack of fill material, to go undetected. This is attributed to use of non-transparent dams to hold the liquid sealant material in place during pouring and curing. In many cases these dams were part of the qualified penetration fire seal and were not removed to inspect the penetration fire seal after installation, or during subsequent inspections.

An evaluation of the failure mechanisms for the four penetration fire seals determined that similar problems probably existed in penetration fire seals that were constructed in 1979. The evaluation also determined that these problems were most likely to occur in penetration fire seals for large blockouts (penetrations) in walls. Additional inspections with damming boards removed, found 31 out of 43 (including the original four) penetration fire seals to be degraded. Floor and ceiling penetrations, and those wall penetrations typically requiring a gap of 4 inches or less to be filled with silicone foam were excluded from the inspection group. These exclusions were based on the floor/ceiling penetrations not needing a dam on both sides of the penetration to contain the liquid seal material during pouring and curing, and the small area to fill for those penetrations with gaps of 4 inches or less. Also, some penetration fire seals for large wall blockouts, constructed with SE-Type silicone foam material and using different construction techniques, were scheduled for inspection after Plant startup.

During this series of inspections, other types of defects in penetration seals were found. The expansion of silicone foam injected to repair voids, gaps, and splits has led to tears or splits in the existing silicone foam seal. This is attributed to pressure exerted by the expansion of the silicone foam used in the repair on the existing seal material. Also, gaps existed at the periphery of approximately 12 percent of the large wall blackout penetration fire seals having either no damming board, or a damming board only on one side. The gaps penetrated through the penetration fire seal in approximately 8 percent of the cases, with the remainder being either a partial pulling away of the silicone foam from the wall at the front edge of the foam or a gap extending part way through the foam seal.

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TEXT (If more space is required, use additional NRC Form 386A's) (17)

An inspection of penetration fire seals similar to those above, but using SE-Type silicone foam sealant material, was completed by September 20, 1990. This inspection did not find voids or indications of age degradation. The compensatory measures of TTS 3.7.9 were maintained until the completion of these inspections.

A decision was made to destructively examine some penetration fire seals to determine if problems existed in the interior of the seal. These examinations would provide additional data from which Design Engineering could evaluate the potential for additional voids and degradation in other silicone foam penetration fire seals. Design Engineering recommended that Seal 603 and two other seals be destructively examined. Seal 603 was chosen as it is one of the largest wall blockout (total square feet of opening) silicone foam fire seals in the Plant. This seal has a high percentage of the opening occupied by cables, cable trays, and conduits which results in a very complex geometry for installation of the silicone foam material. The other two seals were chosen because they are representative of other seal configurations used in the Plant.

During the end of October, the destructive examination of Seal 603 was performed. In addition to split and void problems, the examination also identified the density and cell structure of the silicone foam was below acceptable limits in a portion of the penetration fire seal. Representatives of the seal manufacturer have examined the problems identified in Seal 603 and worked with Design Engineering to determine what additional corrective actions needed to be taken.

As a result of the data from the previous inspections and the destructive examination of Seal 603, a conservative decision was made to declare 17 other penetration fire seals non-functional and establish compensatory measures in accordance with TTS 3.7.9. These fire seals have the same characteristics as Seal 603 in that they are large wall blockout seals with multiple penetrations. The surface of these seals generally displayed the same characteristics as Seal 603 displayed. A schedule for resolution of these seal problems will be developed by February 28, 1991.

Significant problems were not identified during the destructive examination of the other two seals. There are 21 other seals similar to these two seals installed in the Plant. These 23 seals are considered functional. However, an evaluation will be performed to determine if any further action is warranted for these seals as they were installed using the same method, material, and contractor as Seal 603. Any further actions would be included in the schedule to be developed by February 28, 1991 for resolving seal problems.

Evaluations of the inspection data concluded, on June 15, 1990 for seal surface indications and November 29, 1990 for seal interior indications, that some penetration fire seals have been non-functional for an extended period of time

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TEXT (If more space is required, use additional NRC Form 308A's) (17)

(greater than seven days and possibly since original construction of the seals) due to inadequate construction techniques. This is a condition prohibited by the TTS and is reportable per Title 10 of the Code of Federal Regulations, Part 50.73(b)(2)(i) [10 CFR 50.73(b)(2)(i)].

The Action Statement of TTS 3.7.9, "Penetration Fire Barriers", requires the submittal of a Special Report whenever a fire barrier is non-functional for more than seven days. The east wall of the Cable Spreading Room became non-functional on October 25, 1990 when penetration fire seal 603 was removed for destructive examination of the silicone foam material. The fire barrier was not restored within seven days of removal from service due to the size and geometrical complexity of the seal. This report also constitutes a Special Report in accordance with the requirements of TTS 3.7.9. The current schedule for restoration of the fire barrier to functional status is December 14, 1990.

Portland General Electric Company's (PGE's) review of IN 88-56 had identified, in June 1989, that an evaluation of the adequacy of foam penetration fire seals was needed. This evaluation would determine from construction records whether degraded conditions were present, determine the need for inspections, and identify an appropriate inspection population. Also identified was the need to revise the procedure used to inspect, repair, or install foam seals. These procedure revisions would require removal of damming boards for inspections if used to install or repair a foam fire barrier, as well as require the use of temporary transparent damming boards during repair, modification, or construction of penetration fire seals.

CAUSE OF OCCURRENCE

The probable cause of the degraded seals which utilized damming boards was a lack of proper installation techniques and inspection requirements during original construction of the penetration fire seals. A contributing cause is that TTS 4.7.9 surveillance inspections were performed without removal of damming boards to permit an actual inspection of the condition of the sealant material.

The cause of the other defects in wall blackout type penetration fire seals is attributed to aging and wear.

CORRECTIVE ACTIONS

1. Immediate corrective action upon identification of non-functional fire barriers was to implement the compensatory actions required by TTS 3.7.9 (continuous fire watch, or operable fire detectors and roving fire watch) for non-functional fire barrier penetrations.

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TEXT (If more space is required, use additional NRC Form 356A's) (17)

2. An inspection was completed of selected penetration fire seals, with the damming boards removed, to determine if there was visible degradation of the seals.
3. Each degraded penetration fire seal identified during the Spring 1990 inspections was restored to functional status within seven days of identification. Penetration fire seals protecting safety related equipment that also function as High Energy Line Break barriers were repaired prior to entering Mode 4 (Hot Shutdown) after the 1990 refueling outage.
4. Inspections of other large wall blackout penetration fire seals constructed with SE-Type of silicone foam material were completed by September 20, 1990. In the interim, the compensatory actions required by TTS 3.7.9 were maintained for these penetrations. An evaluation of the data from these inspections concluded that seals constructed with this type of silicone foam were functional.
5. The evaluation to determine if changes in inspection techniques or frequency of inspection for degraded penetration fire seals attributed to aging, originally scheduled for completion by December 1, 1990, will be completed when final corrective action for the affected seals is determined. If all affected seals are replaced with SE-Type silicone foam materials, recommendations for inspection requirements and frequency may be different than if some of the existing foam seals are retained.
6. The procedure revisions recommended by the PGE review of IN 88-56 have been completed. Repair and installation techniques had previously been modified during the approximately 1983/1984 time period to require use of transparent damming boards, and removal of temporary damming boards prior to inspection of the seal after seal installation. These modified techniques were included in the revised procedures. Also included in the procedure revisions on repair techniques was a requirement to inspect the foam fire barrier more than 24 hours after the repair to ensure no splits develop from the repair. If repetitive repairs are necessary to correct a split, replacement of the silicone foam will be evaluated. The evaluation recommended by the PGE review of IN 88-56 was accomplished by the evaluations discussed in corrective actions 4 and 5 above.
7. A schedule will be developed, by February 28, 1991, for restoration of the non-functional penetration fire seals.
8. An evaluation will be performed to determine if any further action is required for the 23 functional penetration fire seals constructed using the same method, material, and contractor as Seal 603. If so, these actions will be included in the schedule to be developed by February 28, 1991.

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ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (F-30), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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TEXT (If more space is required, use additional NRC Form 386A's) (17)

PREVIOUS SIMILAR EVENTS

A similar event was reported in a Special Report dated January 6, 1988. This report identified that several penetration fire seals did not meet inspection criteria. The cause was attributed to normal aging of the sealing material and inadequate restoration of the seals following cable installation through the penetration.

SAFETY SIGNIFICANCE

The degraded penetration fire seals, identified in the Spring of 1990, affected 13 fire area boundaries credited for 10 CFR 50 Appendix R separation. A review of the evaluation for these 13 fire area boundaries determined that for nine boundaries there was no effect on achieving safe shutdown. Of the remaining four boundaries, propagation of a fire across one boundary would involve not meeting the intent of Appendix R (Propagation would require use of control stations outside of the control room to achieve safe shutdown, even though the fire did not start in the cable spreading room). Propagation across another boundary would preclude using the desired Control Room location to shutdown the Plant. For the last two boundaries, which separate three adjacent fires areas, a single fire would need to propagate across both boundaries to potentially affect safe shutdown.

For the 17 degraded penetration fire seals identified in the Fall of 1990, an engineering evaluation determined that the seals would provide adequate protection for the existing fire loadings in the adjacent areas. Ten of these seals are located in one of the nine fire area boundaries for which there would be no impact on safe shutdown if a fire propagated across the boundary. Seven of these seal are located in a boundary where propagation of a fire would not meet the intent of Appendix R.

Also, due to other work or problems that have occurred with fire protection components, an hourly fire patrol has normally patrolled the areas affected by non-functional penetrations. Thus, this event did not have any effect on public health and safety.

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