

## LICENSEE EVENT REPORT (LER)

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E F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC  
20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104),  
OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)

Haddam Neck

DOCKET NUMBER (2)

05000213

PAGE (3)

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TITLE (4)

Service Building Technical Specification Fire Barrier Deficiencies

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
01	18	95	95	001	02	09	05	97	FACILITY NAME	DOCKET NUMBER
										05000
										0500
OPERATING MODE (9)		1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)							
			20.2201(b)			20.2203(a)(2)(v)			<input checked="" type="checkbox"/> 50.73(a)(2)(ii)	50.73(a)(2)(viii)
POWER LEVEL (10)		98	20.2203(a)(1)			20.2203(a)(3)(ii)			50.73(a)(2)(iii)	50.73(a)(2)(x)
			20.2203(a)(2)(i)			20.2203(a)(3)(iii)			50.73(a)(2)(iii)	73.71
			20.2203(a)(2)(ii)			20.2203(a)(4)			50.73(a)(2)(iv)	OTHER
			20.2203(a)(2)(iii)			50.36(c)(1)			50.73(a)(2)(v)	Specify in Abstract below or in NRC Form 366A
			20.2203(a)(2)(iv)			50.36(c)(2)			50.73(a)(2)(vii)	

## LICENSEE CONTACT FOR THIS LER (12)

NAME

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPROS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPROS

## SUPPLEMENTAL REPORT EXPECTED (14)

## EXPECTED SUBMISSION

MONTH

DAY

YEAR

YES

(If yes, complete EXPECTED SUBMISSION DATE).

☒

NO

## ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On January 18, 1995, with the plant in Mode 1, at 98 percent power, the Station Fire Protection Engineer conducting a fire barrier inspection found deficiencies in two separate Technical Specification controlled fire barriers which affected operability of the barriers. One grout fire seal was found in a degraded condition around mechanical penetrations in a four inch diameter core bored opening in a Control Room fire barrier. The second deficiency was noted in a Turbine Building fire barrier. This deficiency involved a 2 inch by 7 inch through wall opening at the top of the wall just below the metal roof deck. The cause of the first deficiency was an inadequate original seal installation which lead to degradation over time due to vibration of the mechanical penetrating items. The second deficiency can be attributed to incomplete original installation detail in the construction of the wall. Immediate corrective action involved the establishment of a fire watch and the permanent sealing of the openings. Additional deficiencies were noted during and directly following the 18 month fire barrier inspection. This supplemental LER reflects changes in the originally proposed corrective action due to the Haddam Neck plant being in a permanently defueled state.

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BACKGROUND INFORMATION

The wall between the Control Room and the Central Alarm Station (CAS) Corridor in which the degraded grout fire seal was found provides three hour fire rated separation for the Control Room from the remainder of the service building at the 59 feet 6 inch elevation. This penetration, which is a 4 inch diameter core bore opening in the 16 inch thick concrete wall of the Control Room, is for three mechanical penetrating items; a 2 1/2 inch diameter drain / vent line and two 1/4 inch diameter copper tubing lines. A grout fire seal was installed originally in this penetration.

The degraded grout seal was noted while the Inspector was performing a review of the seal as part of the fire barrier / penetration surveillance.

The wall between the Service Building and the Turbine Building, in which the through wall opening was found at the top of the wall, is an eight inch hollow concrete block wall which extends from the 59 feet 6 inch floor level to the bottom of the metal roof deck of the service building at the 76 feet 7 inch elevation. This barrier provides a two hour rated fire separation between the turbine deck and the Service Building areas on the 59 feet 6 inch elevation south of the Control Room.

When this wall was constructed, the general construction detail for the top of the block wall where it meets the metal roof deck was to fill the remaining gap between the last full block and the roof deck with a partial block section and grout the gap between the block and the metal roof deck including the voids in the roof deck. This design detail provided a complete barrier to the bottom of the roof deck. In spite of this detail, a small section of the wall located over the CAS Corridor in the Service Building adjacent to the Control Room was not filled at the top of the wall.

The barrier opening went undetected because of the inability to directly view the surface of the barrier at the top of the wall. On this particular wall, the structural steel for the Turbine Building included a horizontal steel beam which spanned between vertical columns. These horizontal beams are positioned adjacent to the top of the block wall and are offset from the wall surface by approximately two inches. One beam, located directly at the top of the concrete block wall, prevented the through wall opening from being seen from the Turbine Building side of the barrier. On the Service building side, the top of the wall was approximately ten feet above a suspended ceiling in the CAS Hallway. Access above the ceiling was required to view this portion of the wall. At the top of the wall, the opening was obstructed by a steel structural member adjacent to the wall.

This structural member prevented access to the top of the barrier to view the opening unless the inspector was directly in front of the opening at the top of the wall.

During an inspection of fire seals at the end of the corridor, the inspector, located in the darkened area above the suspended ceiling approximately 80 feet down the hallway,

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observed light passing through this opening. Further investigation found the noted opening.

Subsequent to this event, three separate fire seal inoperability events occurred involving a total of 10 fire seals. Seven of the ten were noted during the 18 month barrier inspection (February 10, 1995). Two seals were found subsequent to the 18 month barrier inspection by QC inspectors performing inspection work in the Primary Auxiliary Building (March 3, 1995 event). The final deficient seal was discovered on March 10, 1995, while seal repairs were being made to a fire seal which has been breached to run a new cable. This deficiency resulted from improper seal repair methods which highlighted a programmatic problem in the fire seals installation training program. All of the seal deficiencies were determined to be insignificant from a safety standpoint. Fire watches were posted based on operability determinations to satisfy Technical Specification LCO Actions. Barrier repairs were made as necessary to establish operable fire seals or engineering evaluations written to justify nonconforming conditions.

The fire barriers in which these penetrations were located provided separation of safety-related plant areas from either other safety-related areas or nonsafety-related areas. All of the penetrations were for mechanical penetrating fire barriers which were sealed in the early 1980's as part of the original fire seal project to seal all barriers which separated safety-related equipment from other plant areas (safety-related or nonsafety-related).

## EVENT DESCRIPTION

On January 18, 1995 at 0950 hours, with the plant in Mode 1 at 98 percent power, the Station Fire Protection Engineer conducting a fire barrier inspection found two fire barrier deficiencies in two separate Technical Specification controlled fire barriers which affected operability of the barriers. One grout fire seal was found in a degraded condition around mechanical penetrations in a four inch diameter core bored opening in the reinforced concrete fire barrier separating the Control Room from the CAS Corridor.

The second deficiency was noted in a fire barrier separating the Service Building from the Turbine Building at the 59 feet 6 inch elevation adjacent to the Control Room. This deficiency involved a 2 inch by 7 inch through wall opening at the top of the wall just below the metal roof deck which had not been sealed with grout during original installation of the barrier. These fire barriers are required to be operable by Technical Specification 3.7.7.

These discrepancies were noted by the Station Fire Protection Engineer conducting the Technical Specification required fire barrier surveillance.

On February 10, 1995, at 1415 hours with the plant in Mode 6 (0% power), the Station Fire Protection Engineer conducting a Technical Specification required 18 month fire barrier inspection found four inoperable fire seals and three penetrations with no fire seal installed in five different fire barriers in the Primary Auxiliary Building. All



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but one of the seal deficiencies were found in the charging / metering pump cubicle walls. The final seal deficiency was noted in the fire barrier separating the PAB from the Service Building. These barriers were required to be operable by Technical Specification 3.7.7. A continuous fire watch was established and repair efforts were initiated.

One of the deficient seals was a surface mounted silicone adhesive seal which had pulled away from the surface of the fire barrier as a result of pipe thermal expansion/contraction. Two penetrations had damming material only installed. One silicone foam fire seal had been breached to pull a coaxial cable through which left the foam material damaged. The remaining three penetrations were small diameter penetrations with no seals installed around the mechanical penetrations allowing an unsealed annular space around the penetrating items of between 1/8 inch and 1/4 inch.

On March 3, 1995 at 1630 hours with the plant in Mode 5 at 0% power, a Quality Control inspector notified the Station Fire Protection Engineer of a possible deficient fire seal in the Primary Auxiliary Building charging pump cubicle.

Upon inspection of the suspect seal and the remainder of the seals in the area, the Station Fire Protection Engineer declared two fire seals inoperable. These seals were located in Technical Specification required barriers. A continuous fire watch previously established for fire barrier deficiencies in this area was notified of the two additional deficiencies. No other fire watch was needed to satisfy Technical Specification Actions. Repair activities for these two deficient seals was initiated at this time.

One of the seals was a surface mounted silicone adhesive seal installed around a mechanical penetration. This seal had pulled away from the barrier due to pipe movement / shrinkage and created an opening in the barrier similar to the seal noted in the February 10, 1995 event. The other seal was a silicone adhesive seal that appears to have been a poor original installation. It appears as if only damming material was installed in the opening with a surface coating of silicone adhesive material applied at a later date. This configuration is not a fire rated design. Construction activity in the cubicle may have damaged the surface coating of silicone adhesive exposing the unrated damming material installation.

On March 10, 1995 at 1645 hours with the plant in Mode 5 at 0% power, a Quality Control inspector noted damage in a damming board on the bottom of a large floor fire seal in the barrier which separated the "A" Switchgear room from the Cable Spreading Area within the Service Building. This floor seal is in the 41' 6" Elevation of the Service Building. The damage noted was in a 1 inch layer of damming material which was part of the 3 hour rated fire seal. During breaches of this seal to run new cables, the damming board was knocked or broken out and not properly reinstalled before silicone foam was reinstalled. In some of the breached areas, it appeared as if new foam was not installed following the penetration of the foam material to run the new cable.

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## CAUSE OF THE EVENT

The root cause of the event involving the degraded grout seal can be attributed to past procedure deficiencies with the penetration fire seal program.

This penetration has existed for at least 15 years and was probably created during the modification to the Control Room kitchen. When the mechanical pipeline was added, the opening was sealed with grout most likely without any procedure controls for the installation.

Installation of grout as a fire seal was not performed with a procedure until the late 1980's at Haddam Neck. In the grout installation procedure, details have been provided and quality control hold points established to ensure adequate grout seals and concrete fire barrier repairs are performed. Prior to the establishment of this procedure, there were no documented controls for these installations. This lack of control appears to have lead to the installation of a poor quality grout seal around this mechanical piping penetration.

The unsealed section of the fire barrier between the Service Building and the Turbine Building appears to be the result of an isolated omission in the penetration fire seal upgrade program. It appears that this deficiency had existed from original plant construction. Previous walkdowns to determine the acceptability of fire barriers missed this design detail. The omission was probably a result of the difficult viewing of this portion of the fire barrier and / or lack of detailed review by the inspection personnel.

The root cause of the February 10, March 3 and March 10, 1995 events can be attributed to past procedural and program deficiencies which led to inadequate fire seals being installed, improper selection of seal designs for specific applications or failure to identify the requirement to install fire seals. In addition, a secondary cause appears to be inadequate training of installers to make repairs to fire seals following breaches of existing seals to accommodate new cable pulls.

## SAFETY ASSESSMENT

These events, with the exception of the March 10, 1995 event, are considered reportable per 10CFR50.73(a)(2)(i)(B) since the Action Statement for Technical Specification 3.7.7 was not met and is therefore a condition prohibited by the plant's Technical Specifications.

In the case of the deficient grout seal, this seal did not provide a rated fire seal but did have inherent fire resistance with the remaining grout seal. No direct through wall openings could be observed but air leakage through the grout seal was noted. Declaring this seal inoperable was a conservative action. The remaining grout material would have served to retard the spread of fire across the barrier through the 4 inch core bored

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opening. The location of this penetration is such that there is no direct fire exposure to this wall due to the lack of combustible loading on both sides of the barrier. The installed smoke detection system and Halon 1301 suppression system in the Control Room would have effectively mitigated any fire effects in the unlikely event that fire breached this seal.

In the case of the through wall opening in the Service to Turbine Building barrier, the opening was located over the suspended ceiling of the CAS Corridor and communicated to the Turbine Building in an area where no installed combustibles were located. There would have been a limited fire exposure to the opening and no direct flame impingement from any expected fire in the turbine building.

Heat and smoke build-up in the area would not be a concern due to the high bay construction of the Turbine Hall which would have effectively vented heat and products of combustion minimizing any smoke / heat migration into the Service building CAS Corridor.

The safety significance of this event was negligible due to the low probability of a fire breaching the barriers through either the degraded seal or the ungrouted barrier opening. In addition, the installed fire detection and suppression system in the Control Room would have acted to mitigate any fire exposure to the Control Room complex in the remote case that a fire did expose either or both barriers and extended into the Control Room.

The March 10, 1995 event occurred after Haddam Neck has removed fire protection from Technical Specifications. This event is being included in this supplemental report as a programmatic deficiency with the Fire Protection Program.

In the cases involving the seal discrepancies in the PAB, none of these conditions were safety significant. This assessment is based on the fact that the barriers were separating fire areas with very low or negligible fire loading. Therefore, there would have been minimal fire exposure to the barriers with the deficient or missing seals. The three missing seals were in small wall penetrations (one inch diameter to 1 1/2 inch diameter) with small annular spaces between the barriers and the penetration (1/8 to 1/4 inch). The potential for fire passage across the barrier through these small annular spaces due to the thickness of the walls and the lack of any combustible materials in the penetration is nonexistent. The deficient fire seal in the Service Building, "A" Switchgear Room floor did not create any through opening between fire areas. The damaged / missing damming board on the bottom of the seal was determined to not be needed to support the one hour fire rating requirement for this fire barrier. The existing 9 inch layer of silicone foam provided adequate fire resistance to prevent fire spread between areas. As such, there was no safety significance to this event.

The noted deficiencies in the subject fire seals and the small unsealed penetrations found during the field walkdowns of the fire barriers were not considered capable of allowing the rapid spread of fire between areas.



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## CORRECTIVE ACTION

The immediate corrective action was to establish a continuous fire watch in the CAS Corridor to monitor both barriers and initiate work activities to replace the grout seal and grout the barrier opening. Repairs have been completed and the barriers returned to operable status.

For the case of the degraded grout seal, one long term corrective action has previously been accomplished with the development and use of a grout installation procedure. Use of this procedure will assure adequate grout seals are installed in the future. The Technical Specification required fire seal inspection program reviews installed grout fire seals and provides monitoring of their condition.

The barrier through wall opening is considered an isolated event. All required Appendix R fire barriers were evaluated during the Appendix R Program development and a number of deficiencies were found at that time. These deficiencies were either corrected or engineering evaluations were performed to justify accepting the deficiencies "as-is" in accordance with a methodology allowed in NRC Generic Letter 86-10. These evaluations are on file with Haddam Neck for review.

For the February 10, March 3 and March 10, 1995 events, immediate corrective actions for each event was to post the required fire watch and initiate repair activities. The PAB fire seals were repaired or new seals installed to restore or establish fire rated penetration seals. The Service Building floor fire seal was evaluated as acceptable without the damming board. The seal provides an equivalent one hour (minimum rating required) fire rating with 6 inches of silicone foam. Repairs were made to several locations of the seal to establish a sound 6 inch thickness of foam around the damaged areas to ensure the one hour fire rating.

In 1990, Haddam Neck performed an upgrade of the penetration fire seal program. This upgrade provided improved installation procedures, a set of qualified fire seal designs and a detailed set of fire barrier / fire seal location maps. The upgrade project also included a walkdown of installed fire seals to verify the condition of seals against the qualified seal designs. It appears from the number of minor deficiencies noted with the seal population since 1990 that the field walkdown portion of this project was not completely effective in validating the installed conditions. Post installation inspections of fire seals have proven to be difficult based on the limitation of performing a visual inspection of the exterior surface of the fire seal. Any dismantling of the fire seal to investigate the condition of the seal would be destructive and would render the seal inoperable requiring reinstallation. This type of inspection would be counterproductive. There does seem to be a need to provide a more conclusive inspection of the fire seals beyond the visual surface inspection.

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To address the fire barrier and fire seal concerns, a field walkdown to evaluate the field condition of the fire barriers and fire seals in Appendix R fire barriers will be performed. This evaluation will be performed to develop a qualitative assessment of the installed fire barriers and fire seals against fire rated design configurations. The inspection will involve a physical probe of the fire seals to attempt to validate the installation in a non-destructive manner. This may be done by removing damming material to verify seal product types and thickness and to evaluate the general material condition of the seal products. Reinstallation of damming material will be performed if needed to re-establish the seal integrity. This type of inspection goes beyond the scope of the visual inspection previously performed. For fire seals and barrier segments that are inaccessible due to location or physical obstructions (cover plates not easily removed), historical information will be used to validate these seals. If no historical information is available, Generic Letter 86-10 Engineering evaluations will be performed to justify as-found conditions.

As an initial step to this barrier / seal walkdown effort, a Cost Beneficial Licensing Action (CBLA) was initiated for Haddam Neck to evaluate all fire barriers and determine which barriers are required to support Appendix R safe shutdown, barriers that are Risk Significant and other barriers important to general loss prevention. This "graded" approach was used in an effort to control the scope and cost of the barrier / seal evaluation effort. Those barriers required to support safe shutdown were reviewed and evaluations to assess the fire resistant capabilities of the barriers were performed. The CBLA effort was completed approximately January, 1996. The final document was used to develop the list of fire barriers which would be inspected. An inspection was started approximately January 1996 to inspect all fire barriers which were classified as "safe shutdown" barriers. These barriers were required to support the 10CFR50, Appendix R program. Approximately 75% of these inspections were completed. Once the decision was made to permanently cease power operation of the Haddam Neck plant, Appendix R was no longer applicable and the safe shutdown fire barrier inspection was terminated.

The 18 month fire barrier inspection, required by the Technical Requirements Manual (TRM), was completed in August, 1996. Fire barriers (other than Appendix R barriers) in the TRM will continue to be maintained as part of the fire protection program until 10CFR50.59 evaluations are performed to remove the barriers from the program as part of the decommissioning process.

A fire seal training program was developed and incorporated into the Nuclear Training Program. The Nuclear Training Department is available to provide initial or refresher fire seal training. The plant fire protection program was revised to require that personnel installing and inspecting fire seals be trained initially and receive refresher training every 5 years. Implementation of this in-house training program will ensure that fire seal installers maintain a suitable knowledge level following initial training to support adequate fire seal installations.

In general, considering the efforts which have gone into evaluating and upgrading the fire barrier / penetration seal program at Haddam Neck over the years, the barriers are



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capable of providing a level of protection against the spread of fire which supports the Appendix R goals. As can be seen from a review of the Safety Assessments of previous reportable events, there has been no significance to any of the barrier breaches or seal inoperabilities. The fire protection "defense in depth" approach provides suitable margin to accommodate the minor barrier deficiencies which occasionally are discovered.

## ADDITIONAL INFORMATION

This supplemental LER reflects changes in the originally proposed corrective action (as documented in letter from F. R. Dacimo to the U. S. Nuclear Regulatory Commission, dated July 25, 1995) due to the Haddam Neck Plant being in a permanently defueled state. The subject changes are documented below.

- The remaining 25% of the safe shutdown barriers will not be inspected.
- Fire barrier inspections required by the TRM will continue to be performed on those fire barriers which are deemed necessary to support the decommissioning process.

## PREVIOUS SIMILAR EVENTS

LER's: 86-017-00, 87-004-01, 87-014-00, 89-001-01, 89-019-00, 90-002-00, 92-008-00,  
93-003-00