

PLANT SYSTEMS

3/4.7.8 FIRE BARRIER PENETRATION SEALS

LIMITING CONDITIONS FOR OPERATION

3.7.8 All fire barrier penetration seals, including cable penetration seals, fire doors and fire dampers, in fire zone boundaries protecting safety related areas shall be functional.

APPLICABILITY: At all times.

ACTION:

- a. With one or more of the above required fire barrier penetration seals non-functional, if the penetration has a cross-sectional area $> 20 \text{ in.}^2$, within one hour:
 1. Establish a continuous fire watch on at least one side of the affected fire barrier penetration seal(s), or
 2. Verify the OPERABILITY of the fire detection instruments providing coverage for the fire detection zones on each side of the non-functional barrier penetration seal(s) by performance of the surveillance requirements of Specifications 4.3.5.7.1 and 4.3.5.7.2, as applicable, or
 3. Verify the OPERABILITY of the fire detection instruments on one side of the non-functional fire barrier penetration seal(s) and establish an hourly fire watch patrol.
- b. With one or more of the above required fire barrier penetration seals non-functional, if the penetration has a cross-sectional area $\leq 20 \text{ in.}^2$, within one hour:
 1. Verify the OPERABILITY of the fire detection instruments providing coverage for the fire detection zones on each side of the non-functional barrier penetration seal(s) by performance of the surveillance requirements of Specifications 4.3.5.7.1 and 4.3.5.7.2, as applicable, or
 2. Establish an hourly fire watch patrol on at least one side of the affected fire barrier penetration seal(s).
- c. Restore the non-functional fire barrier penetration seal(s) to functional status within 14 days or, in lieu of any other report required by Specification 6.9.1, prepare and submit a Special Report to the Commission pursuant to Specification 6.9.2 within the next 30 days outlining the action taken, the cause of the non-functional penetration and plans and schedule for restoring the fire barrier penetration seal(s) to functional status.

ACTION: (Cont'd)

- d. The provisions of Specifications 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.7.8.1 Each of the above required fire doors shall be verified to be functional:

- a. At least once per 92 days by a visual inspection, and
- b. Prior to restoring a fire door to functional status following repairs, by performance of a visual inspection of the affected door.

4.7.8.2 Each of the above required fire barrier penetration seals, with the exception of fire doors, shall be verified to be functional:

- a. At least once per 18 months by a visual inspection if the seal is >20 in.² in cross-sectional area, or
- b. At least once per 5 years by a visual inspection of $20\% \pm 5\%$ annually of seals ≤ 20 in.² in cross-sectional area; and
- c. Prior to restoring a fire barrier penetration seal to functional status following repairs, by performance of a visual inspection of the affected fire barrier penetration.

PLANT SYSTEMS

BASES (Continued)

3/4.7.7 FIRE SUPPRESSION SYSTEMS (Continued)

In the event the fire suppression water system becomes inoperable, immediate corrective measures must be taken since this system provides the major fire suppression capability of the plant. The requirement for a twenty-four hour report to the Commission provides for prompt evaluation of the acceptability of the corrective measures to provide adequate fire suppression capability for the continued protection of the nuclear plant.

3/4.7.8 FIRE BARRIER PENETRATIONS

The functional integrity of the fire barrier penetration seal(s) ensures that fires will be confined or adequately retarded from spreading to adjacent portions of the facility. This design feature minimizes the possibility of a single fire rapidly involving several areas of the facility prior to detection and extinguishment. The fire barrier penetration seal(s) are a passive element in the facility fire protection program and are subject to periodic inspections.

The barrier penetration seal(s), including cable penetration seals, fire doors and dampers are considered functional when the visually observed condition is the same as the as-designed condition. For those fire barrier penetration seals that are not in the as-designed condition, an evaluation shall be performed to show that the modification has not degraded the fire rating of the fire barrier penetration seal.

During periods of time when the seals are not functional, a means of providing for prompt detection and initiation of manual fire fighting efforts will be provided. Such means will consist of the verification of detector OPERABILITY, the use of a fire watch, or a combination of the two until the seal is restored to functional status.

PLANT SYSTEMS

3/4.7.8 FIRE BARRIER PENETRATION SEALS

LIMITING CONDITIONS FOR OPERATION

3.7.8 All fire barrier penetration seals, including cable penetration seals, fire doors and fire dampers, in fire zone boundaries protecting safety related areas shall be functional.

APPLICABILITY: At all times.

ACTION:

- a. With one or more of the above required fire barrier penetration seals non-functional, if the penetration has a cross-sectional area $> 20 \text{ in.}^2$, within one hour:
 1. Establish a continuous fire watch on at least one side of the affected fire barrier penetration seal(s), or
 2. Verify the OPERABILITY of the fire detection instruments providing coverage for the fire detection zones on each side of the non-functional barrier penetration seal(s) by performance of the surveillance requirements of Specifications 4.3.5.7.1 and 4.3.5.7.2, as applicable, or
 3. Verify the OPERABILITY of the fire detection instruments on one side of the non-functional fire barrier penetration seal(s) and establish an hourly fire watch patrol.
- b. With one or more of the above required fire barrier penetration seals non-functional, if the penetration has a cross-sectional area $\leq 20 \text{ in.}^2$, within one hour:
 1. Verify the OPERABILITY of the fire detection instruments providing coverage for the fire detection zones on each side of the non-functional barrier penetration seal(s) by performance of the surveillance requirements of Specifications 4.3.5.7.1 and 4.3.5.7.2, as applicable, or
 2. Establish an hourly fire watch patrol on at least one side of the affected fire barrier penetration seal(s).
- c. Restore the non-functional fire barrier penetration seal(s) to functional status within 14 days or, in lieu of any other report required by Specification 6.9.1, prepare and submit a Special Report to the Commission pursuant to Specification 6.9.2 within the next 30 days outlining the action taken, the cause of the non-functional penetration and plans and schedule for restoring the fire barrier penetration seal(s) to functional status.

ACTION: (Cont'd)

- d. The provisions of Specifications 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.7.8.1 Each of the above required fire doors shall be verified to be functional:

- a. At least once per 92 days by a visual inspection, and
- b. Prior to restoring a fire door to functional status following repairs, by performance of a visual inspection of the affected door.

4.7.8.2 Each of the above required fire barrier penetration seals, with the exception of fire doors, shall be verified to be functional:

- a. At least once per 18 months by a visual inspection if the seal is >20 in.² in cross-sectional area, or
- b. At least once per 5 years by a visual inspection of $20\% \pm 5\%$ annually of seals ≤ 20 in.² in cross-sectional area; and
- c. Prior to restoring a fire barrier penetration seal to functional status following repairs, by performance of a visual inspection of the affected fire barrier penetration.

PLANT SYSTEMS

BASES (Continued)

3/4.7.7 FIRE SUPPRESSION SYSTEMS (Continued)

In the event the fire suppression water system becomes inoperable, immediate corrective measures must be taken since this system provides the major fire suppression capability of the plant. The requirement for a twenty-four hour report to the Commission provides for prompt evaluation of the acceptability of the corrective measures to provide adequate fire suppression capability for the continued protection of the nuclear plant.

3/4.7.8 FIRE BARRIER PENETRATIONS

The functional integrity of the fire barrier penetration seal(s) ensures that fires will be confined or adequately retarded from spreading to adjacent portions of the facility. This design feature minimizes the possibility of a single fire rapidly involving several areas of the facility prior to detection and extinguishment. The fire barrier penetration seal(s) are a passive element in the facility fire protection program and are subject to periodic inspections.

The barrier penetration seal(s), including cable penetration seals, fire doors and dampers are considered functional when the visually observed condition is the same as the as-designed condition. For those fire barrier penetration seals that are not in the as-designed condition, an evaluation shall be performed to show that the modification has not degraded the fire rating of the fire barrier penetration seal.

During periods of time when the seals are not functional, a means of providing for prompt detection and initiation of manual fire fighting efforts will be provided. Such means will consist of the verification of detector OPERABILITY, the use of a fire watch, or a combination of the two until the seal is restored to functional status.

ENCLOSURE 1

Brunswick Steam Electric Plant, Unit Nos. 1 and 2
Justifications for Fire Protection Technical Specifications
on
Fire Barrier Penetration Seals

Item 3/4.7.8

The term "fire barrier penetration seals" has been inserted throughout the specification in lieu of the term "fire barrier penetration." This has been done to maintain uniformity of terminology as used at Brunswick and to properly identify the component concerned. The terms in use are defined below:

- a. Fire Barrier - A fire barrier constitutes a wall, roof, or floor/ceiling assembly which is designed to limit the spread of fire in a given structure or between structures.
- b. Fire Barrier Penetration - A fire barrier penetration is any hole or opening in a fire barrier, regardless of purpose.
- c. Fire Barrier Penetration Seal - A fire barrier penetration seal is any device or material utilized to seal a penetration in a fire barrier. A fire barrier penetration seal may constitute a door, a damper, or an accepted sealing mechanism such as insulating cement.

Item 3.7.8

The term "cable penetration barrier" has been replaced by "cable penetration seal" for consistency of terminology.

Item 3.7.8.a

The action required when a seal becomes nonfunctional has been defined for two different sizes of penetrations. This change has been made to require a corrective action more nearly attuned to the potential hazard presented by the nonfunctional penetration seal. As presently written, the GE Standard Technical Specifications require a nonfunctional penetration however small to be treated the same as a large penetration. Examples of these two extremes are the case of a one-inch conduit (cross sectional area of 0.865 in.²) and an 11'6" x 14'7" access hatch (cross sectional area of 2.41 x 10⁴ in.²). Obviously, the hazards posed by these two penetrations cannot be equated. To provide a better perspective as to the magnitude of the hazard presented by a particular opening, the case of a standard fire door should be considered. Such a door must be installed in accordance with NFPA 80, "Standard for Fire Doors and Windows", which specifies the clearance distances between the door and the frame, and between the door and the floor. For a 3'6" x 7'0" door, the clearances around the door periphery result in an opening of 57.75 in.², the area equivalent of a circular opening of 8.57 in. diameter.

To determine the limiting size given in the Technical Specifications, the mechanisms by which a fire propagates from one area to another through an opening were reviewed and the magnitude of the hazard evaluated based on penetration size. The following paragraphs discuss the conclusions reached and their bases.

The prime concern with respect to an open fire barrier penetration is the passage of hot combustion gases into the uninvolved area. The major factors controlling the flow of such gases through a penetration are: (1) the pressure differential across the penetration, (2) the physical characteristics of the gases, and (3) the size and shape of the penetration. Since, for a given fire condition, the pressure differential and the characteristics of the gases are the same, the size and shape of the penetration are the variables which will determine the rate of flow of combustion gases to the unexposed area. For example, for a given area, a circular penetration will allow a greater flow than a rectangular penetration. Similarly, the more nearly the shape of a rectangular penetration approaches that of a square, the greater will be the flow through the penetration. The flow characteristics of various sizes and shapes of rectangular penetrations cannot be compared directly on the basis of their area; but, by determining the circular equivalents of each penetration, a direct comparison can be made. The circular equivalent of a rectangular flow path can be established using the relationship presented in the ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineers) Guide and Data Book. This relationship also allows the comparison of flow characteristics of rectangular and circular penetrations. For the case of the fire door sited above, we find that the equivalent circular opening area is 17.28 in.². This area is based on the flow path length past a standard 1 3/4 in. fire door. Considering that other penetrations maintain their cross-sectional area for the entire width of the barrier being penetrated and considering that the minimum barrier thickness is 8" for a three-hour barrier, we find that the equivalent open penetration size is 27.34 in.². To assure conservatism, we assume that the maximum equivalent opening has 0.75 times the above area. This results in an area of 20.5 in.². Thus, from the standpoint of combustion gas flow, a penetration with a cross-sectional area of 20 in.² represents no greater hazard than a closed fire door.

Another concern with an open penetration is transfer of heat by radiation. In this case, the quantity of heat transferred to the uninvolved area is dependent on the cross-sectional area of the penetration. With respect to a fire door, this can only occur at the bottom of the door since the frame door stops prevent radiation around the sides or at the top. For the case of the fire door discussed previously, the area available for radiation is 31.5 in.², the same as a circular penetration with a 6.33 in. diameter.

Since a fire door is considered to be a satisfactory means of sealing a fire barrier penetration, it follows that a penetration with a cross-sectional area which is less than or equal to the opening represented by the closed fire door should be addressed differently than larger penetrations. As can be seen from the two preceding paragraphs, the most limiting area is 20.5 in.². Accordingly, a limit of 20 in.² would be satisfactory if the third mode of fire propagation through an open penetration can be satisfactorily addressed. This mode is discussed below.

The final concern with respect to an open fire barrier penetration is the propagation of fire to the uninvolved area via a combustible material which passes through the penetration [e.g., electrical cable(s)]. If the penetration size is 20 in.², the allowable fill is 40% (8 in.²) for

multiple cables up to a limit of seven cables. Considering that all installed cables have fire retardant jackets, which exhibit self-extinguishing properties, and which, in turn, are fire retardant coated for at least five feet on either side of the penetration, the propagation hazard presented is small.

Based on the preceding arguments, the Technical Specifications ACTION statement has been modified to provide for actions more nearly in agreement with the degree of the hazard presented.

Item 3.7.8.a.2

This item has been retained from the existing Technical Specifications for Brunswick. It is considered to be an acceptable alternative to Action Item a.1., since all areas of the Brunswick Plant are equipped with installed, supervised fire detection systems, all of which alarm in the Control Room. The Control Room is manned 24-hours per day by trained personnel who are familiar with actions to be taken in the event of a fire. Thus, if the detection system is operable, a fire watch is not needed.

As stated in the Technical Specification bases for fire detection instrumentation, "OPERABILITY of the fire detection instrumentation ensures that adequate warning capability is available for the prompt detection of fires. This capability is required in order to detect and locate fires in their early stages. Prompt detection of fires will reduce the potential for damage to safety-related equipment and is an integral element in the overall facility fire protection program."

Item 3.7.8.b.2

Based on the discussion under Item 3.7.8.a above, the requirement for a continuous fire watch has been deleted and an hourly patrol has been specified.

Item 3.7.8.c

This action item has been modified to require penetration seal restoration within fourteen (14) days in lieu of the proposed seven (7) days. This corresponds to the requirements for both suppression and detection systems.

Item 4.7.8.1

Based on in-plant experience, the previously specified interval for fire door surveillance, once per eighteen (18) months, is inadequate. Of the various types of penetration seals used in a plant, the fire door is unique in that it is operated frequently--in some instances, in excess of one-hundred operations a day. No other sealing mechanism approaches this frequency of operation and the vast majority are never disturbed. Due to this physical abuse, the doors require more frequent surveillance.

Item 4.7.8.2

The interval for performing visual inspections of seals, other than fire doors, which have an area $>20 \text{ in.}^2$ will be on an eighteen (18) month interval. Additionally, the interval for inspecting seals $\leq 20 \text{ in.}^2$ in area has been increased to 5 years with approximately 20% of the seals being inspected annually. These changes have been made based on the discussion of seal size and its relationship to the hazard represented as discussed in Item 3.7.8.a above, and on the following considerations:

- a. Some penetrations are located in high radiation areas and a number are in radiation areas.
- b. An effective system for controlling fire barrier penetration work has been initiated.
- c. There are approximately 13,000 fire barrier penetrations in safety-related structures at Brunswick, many of which are in areas where access for inspection is difficult. To perform the inspection, an eighteen (18) month interval requires in excess of two men working full time for the duration of the inspection interval.