VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

W. L. STEWART
VICE PRESIDENT
NUCLEAR OPERATIONS

April 10, 1986

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
Attn: Mr. Lester S. Rubenstein, Director
PWR Project Directorate #2
Division of PWR Licensing-A
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Serial No. 85-781
NO/JDH:vlh
Docket Nos. 50-280
50-281
License Nos. DPR-32
DPR-37

Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNIT NOS. 1 AND 2
10CFR50 APPENDIX R REPORT - REVISION 2

Enclosed is Revision 2 to the Surry 10CFR50 Appendix R Report. Revision 2 consists of revised pages to Volume II, originally submitted on July 6, 1984 (Serial No. 381) and revised November 30, 1984 (Serial No. 692). Revision 2 also includes Volume I which is submitted for the first time. Volume I contains an introduction, description of fire areas, safe shutdown analysis, compliance summary, and alternative shutdown analysis. Please note that Table 1-2 in Volume I also lists the status of our fire protection commitments made prior to the current Appendix R analysis. Four engineering evaluations are also submitted for review.

Ten copies of the information are being submitted. At the request of Mr. J. Stang, NRC, two updated copies are being sent directly to Mr. N. Ahmed at the Franklin Research Center. Please update your existing Volume II in accordance with the Table of Changes.

Very truly yours,

W. L. Stewart

Attachments

1. Volume I (10 copies)
2. Revised pages to Vol. II (10 copies)
3. Engineering Evaluations (10 copies)

Limited Dist
A006
1/10

cc: Dr. J. Nelson Grace
Regional Administrator
NRC Region II

NRC Senior Resident Inspector
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Mr. Chandu P. Patel
NRC Surry Project Manager

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Mr. N. Ahmed (2 complete reports updated through Rev. 2)
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Attachment 3

Engineering Evaluation

#2 - Seismic Separation (Rattlespace) Between Various Concrete Walls

#4 - Penetration Seals

#6 - Use of Fire Protection Water for Auxiliary Feedwater

#8 - Operator Access to Charging Pump Cubicles

2. EVALUATION OF SEISMIC SEPARATION (RATTLESPACE) BETWEEN VARIOUS CONCRETE WALLS SURRY POWER STATION

DESCRIPTION OF EVALUATION

Several buildings, most notably the Auxiliary Building, the Cable Vault/Tunnel, Safeguards, Main Steam Valve Houses, and Containment Spray Pump Houses, have common walls that have a rattlespace (to allow for seismic event movement) between the common wall and a perpendicular wall, primarily containment. In some cases, a combustible material was used as a spacer material during the concrete pour. This evaluation will analyze the potential impact of this configuration on the ability of the barrier to prevent fire spread between fire areas.

AREA DESCRIPTION

The buildings and fire areas with seismic gaps are listed on Table 2-1. A description of the area in terms of boundaries with seismic gaps, combustibles, etc. is provided on the table.

FIRE PROTECTION SYSTEMS

The individual fire protection systems in the fire areas with seismic gaps are listed on Table 2-1. Most of the areas in this evaluation have fire detection that annunciates to the Control Room. In general, areas with larger combustible loadings (over 60 minutes of equivalent fire severity) have fire suppression systems. All areas have manual fire fighting equipment available either within the area or nearby.

SAFE SHUTDOWN EQUIPMENT

Table 2-1 provides a general listing of the safe shutdown components in each of the fire areas involved. This list is not all-inclusive and primarily gives major components in order to provide an indication of the function of the area. Chapters 3 and 4 in Volume I of the Surry 10 CFR 50 Appendix R Report provides a detailed description of the components required for safe shutdown and their location.

EVALUATION

This evaluation is divided into three sections. The first discusses the configuration of the seismic gaps. The second section provides generic justification for the seismic gaps. The third section is Table 2-1 which provides a review, by fire area, of the seismic gap locations and individual justifications.

1. Seismic Gap Configuration

Seismic gaps, or rattlespaces, are standard in the construction of concrete structures. This is especially true in nuclear power plants due to the number of interconnected concrete structures and the need to minimize the potential effects of a seismic event. The job of the rattlespace is to leave enough space between walls (especially perpendicular walls) to permit movement without buckling during a seismic event. In order to create this space, material strong enough to withstand the concrete pour, but flexible enough to give under seismic pressure, is needed. A standard industry practice is to use styrofoam, as apparently was the practice at Surry. Documentation is not currently available that shows removal of the styrofoam. This evaluation will consider that it is still in place. The width of the seismic gaps are approximately 2 inches.

A number of the seismic gaps at Surry were reviewed in the field. The current configuration, which is found on both sides of the wall over seismic gaps, is shown on Figure 2-1 and can be described as follows:

a. ¼" thick angle iron approximately 2" x 2" running the length of the gap is bolted to one wall about 2" from the perpendicular wall.

b. A similar angle iron is bolted to the other wall in the same configuration.

c. The free end of each angle iron has an aluminum strip riveted to it for its entire length.

d. A rubber strip (similar to gasketing) extends between the two aluminum strips.

2. <u>Justifications</u>

There are a number of factors that mitigate the potential of fire spread through the seismic gaps. These factors, along with a justification, are provided below:

a. Fire Detection - Most of the areas involved in the evaluation have either heat and/or smoke detectors that annunciate to the Control Room. Detection systems provide early warning of a fire condition to permit prompt station action. This early notification provides extra time for the fire brigade to assemble and attack the fire while it is still in an incipient stage, thereby reducing the potential exposure to the seismic gap.

b. Fire Suppression - In general, fire areas with a combustible loading that results in an equivalent fire severity of over 60 minutes have a fire suppression system. A fire suppression system is designed to extinguish a fire before it can reach flashover or the point where the fire grows beyond the general area of origin. This will reduce any exposure threat to the barrier.

c. Combustibles - In the areas reviewed, the vicinity of seismic gap was free of combustibles on both sides of the barrier. This will reduce the amount of direct flame impingement on the seismic gap on the exposed side of the barrier. This also means that there is little possibility of ignition on the unexposed side, even if the heat did pass through the seismic gap. In addition, the overall level of combustibles in most of the areas where seismic gaps occur is low (an equivalent fire severity of 20 minutes or less). The exception is the Cable

Vault/Tunnel which has a suppression system. The type of combustibles in the vicinity of the seismic gap is also an important factor. Although there are few, if any, combustibles in the direct vicinity (up to 5 ft.) of the seismic gaps, those that were present were primarily cable insulation. Cable insulation requires a substantial amount of concentrated heat to ignite, and it is unlikely that this would occur via the seismic gaps.

d. Area Configuration - As stated earlier, most of the areas with seismic gaps are on the primary side of the plant. These rooms are large concrete structures with high ceilings that will allow heat to rise and dissipate.

e. Seismic Gap Configuration - There are several factors concerning the seismic gaps that will prevent the passage of heat and flame through the gap. First, the seismic gaps are provided with the barrier described in the first section of the analysis. This barrier is installed on both sides of the gap. This barrier will prevent the passage of heat and flame for most fires in the area. If the fire is close enough to directly impinge on the barrier, the rubber gasket will fail, but the barrier on the other side shielded by the reinforced concrete wall will prevent passage of heat and flame. The combustible fill within the seismic gap may also actually serve to block the passage of flame if there is insufficient oxygen in the gap to permit total combustion.

   Secondly, as mentioned above, the thickness of the walls are an important consideration. The walls involved are a minimum of 12 in. thick, and some go up to 24 in. This thickness will shield the barrier on the unexposed side and permit the fire gases to cool as they pass through the wall. This will also provide extra time for fire brigade action.

f. Safe Shutdown Equipment - There are no major components of the safe shutdown or alternate shutdown systems within the direct vicinity (5 ft.) of the seismic gaps. Of the gaps that were field verified, the closest component to a gap are the RHR power feeds where they enter containment in the electrical penetration area of the Cable Vault and Tunnel (CV/T). These cables were approximately 8 ft. away. The CV/T has detection and suppression.

g. Fire Code Comparison - The passage of limited amounts of gases and even flaming is acceptable for other barrier penetrations. For example, fire door testing as outlined in NFPA-252 paragraphs 6-1.1.1, 6-1.1.2, and 6-1.1.4 permits flaming of up to six (6) inches along the edges of the door.

h. North Anna Comparison - Surry has a seismic gap configuration similar to that found at North Anna Power Station. During the Appendix A (of BTP 9.5-1) process at North Anna, the NRC asked a specific question concerning the configuration and the use of combustible filler material. An answer to that question was provided, and that information is generally applicable at Surry. North Anna's Fire Protection Safety Evaluation Report issued in 1979 did not mention the seismic gaps any further leading to the assumption that the NRC question was satisfactorily answered and settled at that time.

3. See Table 2-1 attached at the end of the evaluation.

CONCLUSIONS

The seismic gap (rattlespace) configuration will provide adequate separation between adjacent fire areas. The technical bases which justify this conclusion can be summarized as follows:

1. The fire areas (which contain shutdown components) have fire detection systems that alarm in the Control Room on both sides of fire barriers with seismic gaps.

2. The fire areas with the seismic gaps in general have combustible loadings that result in an equivalent fire severity of approximately 20 minutes or less. The notable exception, the Cable Vault and Tunnel, has a fire suppression system.

3. The barrier presently installed over the seismic gaps on both sides of the barrier will provide some degree of separation, especially on the unexposed side.

4. The configuration of the structures involved (primarily heavy concrete with high ceilings and cubicles) will limit exposure to the gaps.

5. There are few combustibles and safe shutdown components within the direct vicinity of the seismic gaps.

6. The passage of limited amounts of heat and even flame is permitted by NFPA codes for such barrier penetrations as fire doors.

TABLE 2-1

Fire Area	Fire Protection Systems	Safe Shutdown Systems	Location of Seismic Gap	Proximity of Safe Shutdown Equipment	Justification
I Unit I Cable Vault/ Tunnel (CV/T-I)	Heat and Smoke Detection Total Flooding CO_2 System Manual Open Head Sprinkler System	Numerous control, instrumentation, and power cables for most safe shutdown components	I. At intersection with Service Building. Between CV/T and the Auxiliary.	The Unit I power feeds are near the gap just before they enter the CV/T.	Both sides of the barrier have detection in the vicinity of the barrier. The CV/T has two suppression systems. The only safe shutdown components (SSC) located near the barrier are in the same train.
	Equivalent fire severity in excess of 3 hours		2. At intersection with containment (north side) and the Auxiliary Building	The RHR and RC pump power feeds are approximately 10 feet away on the CV/T side. There are no SSC in the Auxiliary Building near the barrier.	Detection systems are installed in both fire areas. The CV/T has two suppression systems. Both sides do not have combustibles or SSC within 5 ft. of the barrier.

TABLE 2-1

(continued)

Fire Area	Fire Protection Systems	Safe Shutdown Systems	Location of Seismic Gap	Proximity of Safe Shutdown Equipment	Justification
2 Unit 2 Cable Vault/ Tunnel (CV/T-2)	Heat and Smoke Detection Total Flooding CO_2 System Manual Open Head Sprinkler System	Numerous control, instrumentation, and power cables for most safe shutdown components	1. At intersection with Service Building. Between CV/T and the Auxiliary.	The Unit 1 power feeds are near the gap just before they enter the CV/T.	Both sides of the barrier have detection in the vicinity of the barrier. The CV/T has two suppression systems. The only safe shutdown components (SSC) located near the barrier are in the same train.
	Equivalent fire severity in excess of 3 hours		2. At intersection with containment (north side) and the Auxiliary Building	The RHR and RC pump power feeds are approximately 10 feet away on the CV/T side. There are no SSC in the Auxiliary Building near the barrier.	Detection systems are installed in both fire areas. The CV/T has two suppression systems. Both sides do not have combustibles or SSC within 5 ft. of the barrier.

TABLE 2-1

(continued)

Fire Area	Fire Protection Systems	Safe Shutdown Systems	Location of Seismic Gap	Proximity of Safe Shutdown Equipment	Justification
17 Auxiliary Fuel and Decontamination Buildings	Partial Area Smoke Detection Equivalent Fire Severity Area total approximately 23 minutes	Charging pumps Charging pump component cooling water pumps Component cooling water pumps Instrumentation cables	See the CV/T-1 and CV/T-2. 1. Auxiliary Building to Fire Areas 19 and 20, specifically, the Main Steam Steam Valve House.	There are no shutdown components within 10 ft. of either side of the barrier.	Both sides of the barrier have detection and a combustible loading of approximately 20 minutes. There are no safe shutdown components located near the barrier.
			2. Auxiliary Building to Fire Areas 19 and 29, specifically, the containment Spray Pump Room.	The containment Spray Pump Room does not have any safe shutdown components.	Both sides of the barrier have detection and a low combustible loading. There are no safe shutdown components within 5 ft. of the barrier. There are other seismic gaps within Fire Area 17 that communicate to rooms or buildings within Fire Area 17 or to the exterior.

TABLE 2-1

(continued)

Fire Area	Fire Protection Systems	Safe Shutdown Systems	Location of Seismic Gap	Proximity of Safe Shutdown Equipment	Justification
19 Unit 1 Safeguards Building (SG-1)	Smoke Detection Equivalent Fire Severity Less than 10 minutes (approximately 1 minute)	Auxiliary Feed-water Pumps Main Steam Valves	See the Auxiliary Building.		This fire area contains several separate rooms that have been combined for consideration under Appendix R. Therefore, those seismic gaps are not an issue.
20 Unit 2 Safeguards Building	Smoke Detection Equivalent Fire Severity Less than 10 minutes (approximately 1 minute)	Auxiliary feed-water Pumps Main Steam Valves	See the Auxiliary Building.		This fire area contains several separate rooms that have been combined for consideration under Appendix R. Therefore, these seismic gaps are not an issue.

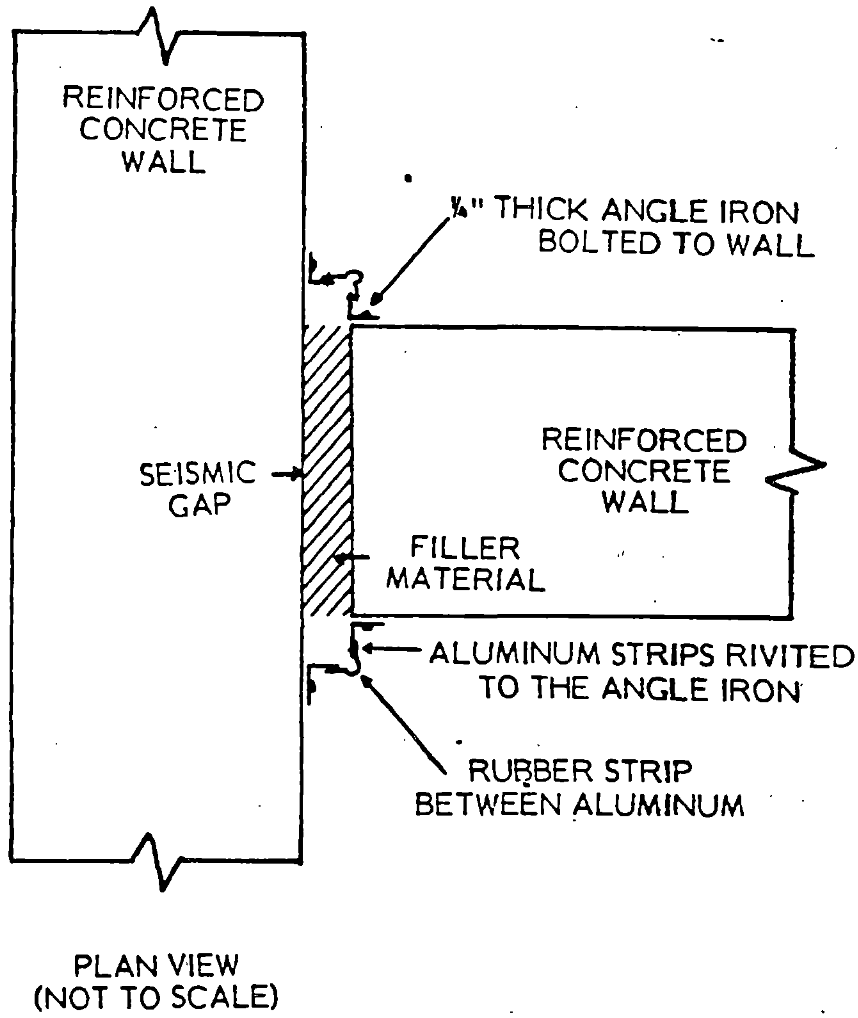


FIGURE 2-1

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION

4. EVALUATION OF PENETRATION SEALS SURRY POWER STATION

DESCRIPTION OF EVALUATION

Penetrations in rated fire barriers are protected by silicone foam seals. The penetration seals are installed in four basic configurations. These configurations of penetrations seals have been tested and determined to have a 3-hour fire resistance rating. This evaluation describes the documentation of the 3-hour fire resistance rating of the penetration seals. Even though the penetration seal configurations are not listed in the Underwriters Laboratory (U.L.) Building Materials Directory, the seals are acceptable for Appendix R and no exemption request is necessary.

EVALUATION

The following items are discussed in this evaluation:

1. NRC Criteria
2. Duxseal, Thickol, and Flammastic Seal
3. Foam and Cerafiber Seal
4. Cable Tray Seal
5. 12-Inch Foam Seal

Each penetration seal configuration is discussed regarding fire resistance test documentation and adequacy of the test.

1. NRC Criteria

Appendix R, Section III.G, requires safe shutdown cables and equipment to be separated such that one train of safe shutdown components is "free of fire damage." One method for ensuring that one train of safe shutdown components is free of fire damage is to provide separation "by a fire barrier having a 3-hour rating." Penetration seals are part of a fire barrier, so they are also required to have a 3-hour rating.

Additional guidance on penetration seals is provided in the NRC's proposed Generic Letter 85-01, Section 8.19.1, which states:

> 8.19.1 Penetration Designs Not Laboratory Approved
>
> QUESTION
>
> Where penetrations designs have been reviewed and approved by NRC but have not been classified by an approval laboratory, will it be necessary to submit an exemption request?
>
> RESPONSE
>
> No.

This guidance states that the following penetration seals are acceptable for Appendix R:

a) those which have been reviewed and approved by the NRC, and

b) those which have been classified by an approval laboratory.

2. Duxseal, Thickol, and Flammastic Seal

This penetration seal consists of 1½ inches of "Thickol" and 2 inches of "Duxseal." Two 1/8" coatings of Flammastic are applied on each end of the penetration.

Documentation of the seal's fire resistance rating is provided via a test report entitled, "Cable Penetration Fire Stop Test." As indicated in the test report, a test was conducted in-house by Virginia Electric and Power Company in November, 1975.

The testing was not performed to ASTM E-119, nor was it tested by an independent laboratory. However, the penetration seal did prevent flame from passing through the seal during the 3-hour test.

The referenced report was submitted to the NRC as an appendix to the "Fire Protection Systems Review" report dated July 1, 1977. The report was reviewed and approved by the NRC for existing penetration seals only, as indicated by the following statement from the Fire Protection Safety Evaluation Report dated September 19, 1979:

> 4.9.1 <u>Electrical Cable and Conduit Penetrations</u>
>
> Electrical cable and conduit penetrations in fire barriers surrounding safety-related areas throughout the plant are sealed using materials and methods which have been tested by the licensee to verify their effectiveness as a fire barrier. We have reviewed the procedures used for these tests and conclude that the existing penetration seals are adequate for most areas of the plant. The licensee's commitments to upgrade penetrations in fire barriers surrounding areas of high combustible loadings are included in the separate discussions for each area in Section 5.0 of this report. Any seals which must be replaced will be sealed using silicone foam installed as approved by the NRC staff or use at North Anna Power Station, Units 1 and 2. We find that, subject to the implementation of the modifications described in this report, the protection of electrical cable and conduit penetrations satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable.

Since this seal was approved by the NRC for existing penetration seals, and based on proposed Generic Letter 85-01, the seal is acceptable for Appendix R.

3. Foam and Cerafiber Seal

This penetration seal configuration consists of 10 inches of Dow Corning Q3-6548 Silicone RTV foam, with 1 inch of Johns-Manville Cerafiber or Cerablanket as permanent damming materials on each end. The total depth of foam and permanent damming material is a minimum of 12 inches.

Documentation of the seal's fire resistance rating is provided via a report entitled, "Fire Endurance Test of Cable Penetration Fire- Stop Seal Systems Utilizing Dow Corning Q3-6548 Silicone RTV Sealing foam," dated February 15, 1977. As indicated in the test report, a test was conducted in-house by Virginia Electric and Power Company, based on an early draft of standard IEEE-P634.

The testing was not performed to ASTM E-119, nor was it tested by an independent laboratory. However, the testing was based on a similar test procedure, and the acceptance criteria for a 3-hour fire resistance rating was achieved.

The referenced report was submitted to the NRC as an appendix to Supplement 1 dated December 15, 1977 to North Anna Power Station's "Fire Protection Systems Review" Report. The report as reviewed and approved in North Anna's Fire Protection Program Safety Evaluation Report dated February, 1979.

This report was subsequently approved for use in new penetration seals at Surry Power Station as indicated by the following statement from Surry's Fire Protection Safety Evaluation Report dated September 19, 1979:

> "Any seals which must be replaced will be sealed using silicone foam installed as approved by the NRC staff for use at North Anna Power Station, Units 1 and 2."

Since this seal was approved by the NRC for new penetration seals, and based on proposed Generic Letter 85-01, the seal is acceptable for Appendix R.

4. Cable Tray Seal

This penetration seal configuration consists of the same combination of foam and cerafiber described in Item 3 above, with the addition of a piece of Johns-Manville Marinite XL board permanently attached on each side of the penetration. The board has a cut-out to allow for passage of the tray.

Documentation of the seal's fire resistance rating is provided via the same report referenced in Item 3 above. This test report was submitted to the NRC and was approved for use in new penetration seals at Surry Power Station as discussed in Item 3 above; therefore, based on the proposed Generic Letter 85-01, this penetration seal is acceptable for Appendix R.

5. 12-Inch Foam Seal

This penetration seal configuration consists of 12 inches of Dow Corning Q3-6548 Silicone RTV foam. Nonpermanent damming materials are used to form the seal. These damming materials are removed upon completion of the penetration sealing process.

Documentation of the seal's fire resistance rating is provided via a report entitled, "Fire and Hose Stream Tests of Cable Tray Seals - Dow Test No. 4," dated October, 1984 (a copy is attached). As indicated in the test report, a full-scale ASTM E-814 fire test was conducted by an independent laboratory, Construction Technology Laboratories, at the request of the manufacturer, Dow Corning, U.S.A.

The referenced test report is equivalent to one conducted by U.L., since the test procedure used by U.L. for classifying penetration seals is identical to ASTM-E-814.

The test specimen and test results are discussed as follows. The test specimen consisted of a concrete slab having two identical cable tray penetration seals. The slab was subjected to a 3-hour fire endurance test in accordance with ASTM-E-814, and then subjected to two hose stream tests: one in accordance with IEEE-634 and then one in accordance with ASTM-E-814. (The hose stream test requirements for ASTM-E-814 are identical to those for ASTM-E-119).

The acceptance criteria for a 3-hour F rating in accordance with ASTM-E-814 was achieved on one of the two cable tray penetration seals (i.e., no passage of flame and no projection of water thorugh the penetration seal). The reason that failure of one cable tray penetration seal is not a concern is that the seal had already been subjected to and passed in an IEEE-634 hose stream test. This test probably weakened the seal, leading to its failure during the ASTM-E-814 hose stream test.

Based on the fact that the acceptance criteria for a 3-hour F rating was achieved in accordance with ASTM-E-814, it is concluded that this penetration seal configuration is equivalent to being classified by U.L. and is acceptable for Appendix R purposes.

CONCLUSIONS

The penetration seals used at Surry Power Station are acceptable for Appendix R. The bases for this conclusion are as follows:

1. The penetration seals have a 3-hour fire resistance rating as required by Appendix R, Section III.G.

2. The Duxseal, Thickol, and Flammastic seal was tested by Virginia Electric and Power Company. The test report

was submitted to the NRC and was approved for existing (1979) penetrations only.

3. The foam and cerafiber seal configuration and the cable tray seal were both tested by Virginia Electric and Power Company. The test report was submitted to the NRC and was approved for use in new (1979 and later) penetration seals.

4. The 12-inch foam seal configuration was tested in accordance with ASTM E-814 by an independent laboratory. This is equivalent to being classified by an approval laboratory.

6. EVALUATION OF THE USE OF FIRE PROTECTION WATER FOR AUXILIARY FEEDWATER SURRY POWER STATION

DESCRIPTION OF EVALUATION

In the event of an Appendix R FIRE, certain scenarios may require the use of a portion of the fire protection water supply in order to provide water for the Auxiliary Feedwater system (AFW). The purpose of this evaluation is to show that there will be sufficient fire protection water to supply water to the AFW pumps, and to provide water for both automatic and manual fire fighting activities associated with the Appendix R scenario.

BACKGROUND

Appendix R scenarios normally include a fire in an area where safe shutdown equipment is affected and a concurrent loss of off-site power requiring the affected unit to be brought to hot standby and, subsequently, cold shutdown. These scenarios require the use of the AFW pumps to deliver water to the steam generators which provide heat removal for the reactor coolant system.

Water is initially supplied to the AFW pumps from the above ground Emergency Condensate Storage Tanks (1-CN-TK-1A and 2-CN-TK-1A for Units 1 and 2, respectively). These tanks have a controlled (via Technical Specifications) volume of 96,000 gallons, but have a capacity of 110,000 gallons.

The preferred secondary source of AFW is the below ground emergency make-up condensate storage tanks which have a capacity of 100,000 gallons (one per unit). These tanks, the water level in the tanks, and the booster pumps are not controlled by Technical Specifications and, therefore, cannot be relied upon for Appendix R concerns. However, if the booster pumps will start and remain operating and the tank contains water, the operator can line up valves to either supply the AFW pumps directly or through the Emergency Condensate Tank.

The preferred tertiary source of water is the normal condensate storage tanks (one per unit). These tanks are connected to their respective unit's Emergency Condensate Tanks. The normal condensate storage tanks are not controlled by Technical Specifications. They have a capacity of 300,000 gallons each.

The ultimate back-up source of water to supply the AFW pumps is the fire protection water supply. This supply is used only if the secondary and tertiary sources are unavailable. The amount of water from the fire protection water supply that would be required for the AFW pumps would vary depending on a number of factors. The Nuclear Engineering Department has performed a worst-case analysis and determined that approximately 255,000 gallons would be required from the fire protection water supply. This amount is roughly equal to the capacity of one of the fire protection water storage tanks which is half of the stored fire protection water supply.

ANALYSIS

This analysis will focus on the worst case scenario in which 255,000 gallons of the fire protection water supply is to be used to supply the Auxiliary Feedwater Pumps. It is important to note, however, that the use of fire protection water for AFW is a remote possibility. Both the initial use and the quantity of the fire protection water needed is based on:

1. Unavailability of the secondary or tertiary water supplies (which total 400,000 gallons per unit);
2. Unavailability of equipment, such as shroud coolers, that would reduce the amount of AFW needed.

The most critical potential effect of the use of fire protection water for AFW is the inability of the fire protection water supply to meet fire flow demands simultaneously with meeting AFW demand. In order to determine if the fire protection demands can be met when 245,000 gallons (or half the dedicated fire protection water supply) are available for fire fighting, an analysis of the following factors must be performed.

1. Fire protection water supply system

2. Water-based fire suppression systems

3. Fire flow demands

4. Other factors including: fire location, alternate water sources, operational priority and fire duration

FIRE PROTECTION WATER SUPPLY

The 1979 Fire Protection Safety Evaluation Report (SER) issued by the NRC for Surry Power Station describes the fire protection water supply in Section 4.3.1. This description is still accurate and is paraphrased as follows:

> Water for fire fighting is obtained from two (2) 300,000 gallon water storage tanks, each with 250,000 gallons reserved exclusively for fire protection. A standpipe in each tank allows the top 50,000 gallons to be used for domestic purposes. Each tank has a separate line into the adjacent fire pumphouse suction header. This pumphouse contains two (2) fire pumps (one diesel driven and the other motor driven) that are rated at 2,500 gpm at 100 psi each. The two (2) fire pumps are separated by a 3-hour fire rated barrier into separate enclosures. Both pumps start automatically upon loss of pressure in the fire main and can be manually started locally or remotely from the Control Room.

WATER-BASED FIRE SUPPRESSION SYSTEMS

Surry Power Station has a number of water-based fire suppression systems (i.e., sprinklers, water spray, or foam) as well as manual fire fighting equipment including hose stations and yard hydrants. The water based fire suppression system includes, but is not limited to:

1. The Turbine Building except for the operating floor has automatic sprinklers.

2. The major lube oil components in the Turbine Building have deluge systems.

3. The main and auxiliary station transformers have deluge systems.

4. Portions of the Service and Administration Buildings have automatic sprinklers.

5. The Laundry Building has automatic sprinklers.

6. The cable vault and tunnel for both units have open and closed head manually activated sprinkler systems.

7. The Machine Shop Building has automatic sprinklers.

8. The Condensate Storage Building has automatic sprinklers.

9. Standpipes with hose stations are located in most of the buildings.

FIRE FLOW DEMAND

The largest demand area at Surry is the Turbine Building, which was calculated by the original insurance carrier to be 2,264 gpm plus 1000 gpm for hose streams, resulting in a demand of 3,264 gpm at 104 psi at the fire pump. This is an extremely conservative number based on a design density of .20 gpm/ft.^{2} over 10,000 ft.^{2}

The configuration of the Turbine Building makes it extremely unlikely for 10,000 sq. ft. of sprinkler heads to open for a single fire for the following reasons:

1. The major lube oil components have trenches or dikes around them to contain oil, and they have deluge water-spray systems which are independent of the sprinkler system.

2. The floors between elevations of the Turbine Building are partially metal grating. This arrangement allows heat to rise without spreading through an entire elevation. The roof has exhaust fans to remove heat and smoke. In addition, oil spills will run to the lowest elevation where there are numerous drains.

3. Cable insulation is the primary combustible (in terms of quantity and BTU output) in the Turbine Building. Cable insulation propagates slowly in the horizontal direction and normally requires an external ignition source.

4. The original insurance carrier obviously took a very conservative approach. The use of 10,000 sq. ft. is primarily for design consideration in sizing pumps, pipe and water supply. Industry experience has shown that most fires are controlled by only a few sprinkler heads in the immediate vicinity of the fire (Fire Protection Handbook, 15th Edition, Section 17-1).

Therefore, a sprinkler demand much lower than 2,264 gpm can be expected under most fire conditions in the Turbine Building.

The use of 1,000 gpm as the hose stream contribution to the fire flow demand was taken from Section E.2(e) of Appendix A to the Branch Technical Position (BTP) 9.5-1. Although Surry Power Stations commitments are based on this document, a subsequent revision to the BTP, dated July 1981, reduced the hose stream contribution to 500 gpm in Section C.6.b(11). This figure is more in line with the hose stream contributions given in Table 2.2-1(B) in NFPA-13 (1985) for Ordinary Group 3 and Extra Hazard occupancies which is also 500 gpm.

A more realistic estimate of the actual fire flow demand for the Turbine Building can be made as follows:

1. The original insurance carriers criteria was .2 gpm/ft.^{2} over 10,000 ft.^{2} and .3 gpm/ft.^{2} over 3,000 ft.^{2}. If the .3 gpm/ft.^{2} over 3,000 ft.^{2} is used instead of the first number, the sprinkler flow demand becomes roughly 900 gpm (.3 gpm/ft.^{2} x 3,000 ft.^{2}).

2. The updated BTP and the 1985 edition of NFPA-13 represent the current philosophy of the hose stream requirements. Therefore, 500 gpm should be considered.

3. Combining the new sprinkler demand and hose stream demand together results in 1400 gpm. This flow rate for two hours (which is the duration required for consideration in both Appendix A to the BTP and the updated BTP) is 168,000 gallons, well within the 245,000 gallons available.

The second largest fire flow demand is from the main station transformers located just to the south of the Turbine Building. The flow requirement is 825 gpm per transformer. Although there are fire walls between the transformers, past experience has shown that at least one other transformer deluge system will trip (or be manually tripped to protect that transformer). So, considering two transformer systems operating and a hose stream contribution of 500 gpm, the resulting flow of 2,150 gpm can be supplied by the 245,000 gallons of fire protection water for almost 2 hours.

The other suppression systems flow demands fall well within the capability of the 250,000 gallons of fire protection water available for a flow duration of 2 hours. Therefore, a fire protection water supply of 245,000 gallons will provide an adequate amount of water to supply fire suppression systems and manual hose stations.

OTHER FACTORS

There are a number of other factors that will affect the amount of fire protection water needed and available for both fire protection and AFW use. Several of these items for the AFW system were listed at the beginning of the analysis. One factor that affects both the AFW system and fire protection is the location of the fire. A fire in areas containing safe shutdown system components will more likely require AFW. However, most areas containing safe shutdown system components do not have water-based suppression systems or they are very limited in size (i.e., the manual sprinkler system in each Unit's Cable Vault and Tunnel which also has a CO_2 system). The Turbine Building has safe shutdown components, but a fire disabling these components would not affect the use of the other AFW back-up sources, so fire protection water should not be required.

Another factor is the availability of other water sources for fire fighting purposes. Bodies of water are available near the plant to permit supplying water to the fire trucks via drafting. This water would be available to supply hand streams.

The duration of the fire is another important factor in determining water requirements. The NRC normally considers 2 hours as the duration for determining fire water flow demand. Most fires will obviously be extinguished in less time, especially if an automatic suppression system is involved. More stubborn fires often involve combustible liquids (such as the transformers or lube oil systems). Manual foam-water hose streams require less water which are often used for this type of fire.

A final factor is the operational priority determined by the shift supervisor. Safe shutdown of the plant is the main priority and fire extinguishment, although important, is secondary to this. If necessary, a holding action (i.e., protection of exposures and the use of manual hose lines supplied by fire trucks) can be used on the fire if the water is needed for AFW. This is a standard practice in fire fighting when there is a limited water supply or the size of the fire is so great that application of water to the main body of the fire does not provide significant cooling.

CONCLUSIONS

The fire protection water supply provides the ultimate back-up source for the Auxiliary Feedwater system. It is estimated that the maximum amount of fire protection water needed for this purpose is 255,000 gallons, which is half of the available stored supply. Based on the above analysis, it can be concluded that the remaining 245,000 gallons will provide an adequate supply for fire fighting operations in all plant areas, even when an automatic water-based suppression system is used.

The bases for this conclusion can be summarized as follows:

1. The fire protection water supply is the final back-up source of water for the AFW system behind other back-up sources totaling approximately 400,000 gallons per unit.
2. Fires in the Turbine Building and at the transformers can be fought with 245,000 gallons of stored fire protection water. These areas have the largest fire flow demand.
3. Fires in areas containing safe shutdown equipment can be fought with 245,000 gallons of stored fire protection water.
4. Most Appendix R scenarios do not involve areas with automatic water-based suppression systems.

8. EVALUATION OF OPERATOR ACCESS TO THE CHARGING PUMP CUBICLES SURRY POWER STATION

DESCRIPTION OF EVALUATION

The purpose of this engineering evaluation is to show that station operators will be able to access the charging pump discharge cross-connection valves within 30 minutes of a fire-induced failure of all three charging pumps of one unit. These valves are located within the same fire area, but are in different fire zones from each other as well as from the cables for the charging pumps.

BACKGROUND

There are three charging pumps for each unit located in cubicles on the 2 ft. elevation of the Auxiliary Building. The arrangement of the pumps is shown in Figure 8-1. At least one operable charging pump per unit is required for safe shutdown. In order to assure the availability of at least two charging pumps, Virginia Electric and Power Company has done the following:

1. A discharge header cross-connect pipe has been installed between the Unit 1 charging pumps and Unit 2 charging pumps. This cross-connect header is normally closed, and isolation valves located outside cubicle 1-CH-P-1C and cubicle 2-CH-P-1C (as shown on Figure 8-1) must be opened when the cross-connect is needed. This discharge cross-connection between the two units' charging pumps is in accordance with the Fire Protection Safety Evaluation Report issued by the NRC in 1979.

2. The charging pumps for one unit are considered to provide alternate shutdown capability to the charging pumps of the other unit and vice versa. Therefore, the power cable routing for the charging pumps were reviewed as part of the Appendix R (to 10 CFR 50) analysis to determine the adequacy of the separation of the Unit 1 cables from those of the Unit 2 charging pumps. It was found that the separation meets the criteria of Appendix R, Section III.G.3 based on the following:

a. Fire Area 17 was divided to fire zones in the vicinity of the charging pumps. Using the zone designations, it can be shown that each unit's charging pumps and power cables are physically separated and electrically independent from one another.

b. An Exemption Request (No. 1) from Appendix R, Section III.G.3 was submitted for the use of partial area detection and lack of suppression. Intervening combustibles have been eliminated and the power cables of one unit's charging pumps are at least 50 ft. from those of the other unit.

3. The charging pump cubicles provide a rated barrier between the two unit's charging pumps at the point where they abut. Therefore, the "worst case" fire that can be postulated is one that will disable the power cables of all thee charging pumps of one unit. To restore charging to the affected unit, the charging discharge header cross-connection must be manually opened via valves outside cubicles 1-CH-P-1C and 2-CH-P-1C. Charging to the affected unit needs to be restored within approximately 30 minutes after its loss to minimize potential Reactor Coolant Pump seal degradation.

In order to access the manual valves, an operator must enter the fire area (Fire Area 17 which includes the Auxiliary, Fuel, and Decontamination Buildings), potentially on the same elevation where the fire occurred that disabled the one unit's charging pumps. It can be shown, however, that the operator can access the valves in a different fire zone than where the fire occurred, and that a number of factors will permit access within 30 minutes of the loss of charging. A fire zone is a smaller division of a fire area as defined by proposed Generic Letter 85-01, Section 3.1.1.

AREA DESCRIPTION

Fire Area 17 consists of the Auxiliary, Fuel, and Decontamination Buildings. For the purposes of this evaluation, only the Auxiliary Building will be considered, primarily since it is not considered credible for a fire originating in the other two buildings exposing the Auxiliary Building. This is based on the fact that all three buildings have a relatively low combustible loading and they are separated by walls and doors (although not rated). In addition, the only source of exposure from these buildings is on the 45 ft. elevation of the Auxiliary Building, which is well above the charging pumps and their power feeds.

The Auxiliary Building is a 4-story structure consisting of the 2 ft.-0 in., 13 ft.-0 in., 27 ft.-6 in., and 45 ft.-10 in. elevations. The CCW, charging pumps, and the charging pump-component cooling water pumps are located on the 2 ft.-0 in. elevation, with the CCW pumps in the main open floor area of this elevation, and each charging pump in a separate cubicle accessed from the 13 ft.-0 in. elevation. The charging pump-component cooling water pumps, two for Unit 1 and two for Unit 2, are located outside their respective units charging pump cubicles as shown in Figure 8-1. Cable for these pumps are routed up to the 13 ft.-0 in. elevation, within their respective cubicles, and then to the respective unit's Cable Vault/Tunnel.

The 2 ft.-0 in. and 13 ft.-0 in. elevations are subdivided into fire zones using the guidance provided by the proposed Generic Letter 85-01, Section 3.1.5, which states, "Where alternate or dedicated shutdown is provided for a room or zone, the capability must be physically and electrically independent of that room or zone." These fire zones are shown on Figures 8-1 and 8-2 and are described in more detail in the evaluation section.

Fire Area 17 is bounded to the south by the Service Building and each unit's Cable Vault/Tunnel (Fire Areas 1 and 2), to the north by the exterior, to the east by Primary Containment and the Cable Vault/Tunnel for Unit 2 (Fire Areas 16 and 2, respectively), and to the west by Primary Containment and the Cable Vault/Tunnel for Unit 1 (Fire Areas 15 and 1, respectively). All barriers that abut adjacent fire areas are of 3-hour rated reinforced concrete construction, and electrical and piping penetrations are sealed with 3-hour rated Dow Corning silicone RTV foam, except for penetrations to the containment.

The main access point into the Auxiliary Building is through its south wall on the 27 ft.-6 in. elevation via a 3-hour rated fire door. Access is provided into each unit's Cable Vault/Tunnel (Fire Areas 1 and 2) on the 13 ft.-0 in. elevation via 3-hour rated fire doors. Access is provided into the Fuel Building at the 45 ft.-10 in. elevation.

FIRE PROTECTION SYSTEMS

All four elevations of the Auxiliary Building have fire detectors (primarily of the ionization smoke detector type). In general, these detectors are located above cable trays and over safe shutdown components, but full area coverage of each floor is not provided.

Each floor has fire extinguishers and hose stations for manual fire fighting.

SAFE SHUTDOWN COMPONENTS

There are a number of safe shutdown components in the Auxiliary Building. However, for the purposes of this evaluation, only the major components required to achieve hot shutdown on the 2 ft.-0 in. and 13 ft.-0 in. elevations are considered. These components are: the charging pumps, the charging pump suction valves, and the charging pump cross-connect isolation valves.

A full list of safe shutdown components including those needed for hot shutdown and cold shutdown is available in Chapters 3 and 4 of the Surry 10 CFR 50 Appendix R Report.

EVALUATION

In order to show that an operator can access the charging pump cross-connection valves within 30 minutes after the loss of one unit's charging capability, the following items must be analyzed:

1. The division of the 13 ft. and 2 ft. elevations of the Auxiliary Building into four fire zones based on the separation of redundant cable and components.
2. The access routes to the charging pump cross-connect valves in terms of emergency lighting, distance, potential obstructions, operator familiarity, and the need for protective equipment.

3. Type, size, and duration of a fire to be expected to expose the access routes and the valves.

4. Station resources, both passive and active, that will impact the fire and the ability of the operator to access the valves. This includes fire protection systems, the station fire brigade, and administrative controls.

This evaluation is based on the assumption that a fire would disable the power cables of all three charging pumps of a single unit. This is a conservative approach since, as explained in the remainder of this evaluation, there is detection in the vicinity of the power cables and a limited amount of combustibles in the area.

I. <u>Fire Zones</u>

The 2 ft. and 13 ft. elevations are each divided into two fire zones using the guidance provided by the proposed Generic Letter 85-01, Section 3.1.5. The zone divisions as well as the primary components of concern for this evaluation are described below:

- Fire zone 17-1a is located on the 2 ft. elevation of the Auxiliary Building and includes the area located on the Unit 1 side (or west) of the centerline (running north-south) of the Auxiliary Building. The component located in this area is the Unit 1 charging pump discharge cross-connect valve. The Unit 1 charging pump cubicles are not considered part of this zone because they have heavy reinforced concrete walls and do not open to the 2 ft. elevation.

- Fire zone 17-1b is located on the 13 ft. elevation and includes the area located on the Unit 1 side (or west) of the centerline (running north-south) of the Auxiliary Building. The zone includes the Unit 1 charging pump cubicles, the Unit 1 charging pump suction valves (1115B and 1115D), and the power cables for the Unit 1 charging pumps.

- Fire zone 17-2a includes Unit 2 areas located on the 2 ft. elevation of the Auxiliary Building east of the centerline described above. The components located in this area is the Unit 2 charging pump discharge cross-connect valve. The Unit 2 charging pump cubicles are not considered part of this zone because they are separated from the zone by heavy reinforced concrete walls and do not open to the 2 ft. elevation.

- Fire zone 17-2b is located on the 13 ft. elevation and includes the Unit 2 area east of the centerline of the Auxiliary Building. The zone includes the Unit 2 charging pump cubicles, the Unit 2 charging pump suction valves (2115B and 2115D), and the power cables for the Unit 2 charging pumps.

The bases for the zone division is the physical separation of the components. This physical separation is summarized below:

- The separation between zones 17-1a and 17-1b is achieved by the physical distance between the charging pump cross-connect valves which is in excess of 50 ft. and the barrier provided by the charging pump cubicle walls. There are no intervening combustibles between the zones.

- The separation between zones 17-2a and 17-2b is achieved by the physical distance between the charging pump power cables and the use of fire stops in cable trays to eliminate intervening combustibles (see Exemption Request 1). The charging pump cubicle walls between Units 1 and 2 reach the ceiling and provide a physical barrier between the cubicles.

- The separation between fire zones 17-1a and 17-2a and 17-1b and 17-2b is achieved by the concrete ceiling/floor between the two elevations in most areas. In the south side of each elevation there is a large opening over the CCW pumps. The opening will permit heat to rise between the zones. However, this configuration is mitigated by the high ceiling and some grating at the top of the 13 ft. elevation, which will allow heat to continue to rise. In addition, the low level of combustibles on the 2 ft. elevation will reduce exposure to the 13 ft. elevation.

2. Access Routes

The normal access path to the charging pump discharge cross-connect valves from the Control Room is as follows:

a. Control Room to the Health Physics area of the Service Building via the Turbine Building corridor.

b. Health Physics area to the Auxiliary Building at elevation 27 ft., and then to the stairway next to the elevator.

c. Down the stairwell to the 13 ft. elevation, and then north along the Unit 1 charging pumps to the stairwell located adjacent to charging pump cubicle 1-CH-P-1A.

d. Down the stairway to the 2 ft. elevation, turn south and head along the Unit 1 charging pump cubicle walls to the charging pump discharge cross-connect valve for Unit 1.

e. Head east along the walls of charging pump cubicles 1-CH-P-1C and 2-CH-P-1C to the Unit 2 charging pump discharge cross-connect valve.

f. The normal exit path would retrace these steps. Emergency lighting is provided for this path.

A fire that could disable all three of one unit's charging pumps may make travel on the upper elevations of the Auxiliary Building difficult. Travel on the 27 ft. elevation can be eliminated by using the doors from each unit's Cable Vault/Tunnel (Fire Areas 1 and 2 for Units 1 and 2, respectively). This results in an access route directly into each fire zone on elevation 13 ft.

This provides an alternate access paths as described below. For a fire in fire zone 17-2b that disables all three of Unit 2's charging pumps, the charging pump discharge cross-connect valves would be accessed as follows:

a. Control Room to the Unit 1 Cable Vault and Tunnel via the Emergency Switchgear Room. (However, Anit-C's should be obtained prior to entry into the Auxiliary Building).

b. Enter the Auxiliary Building into fire zone 17-1b. Proceed east to the stairway next to charging pump cubicle 1-CH-P-1A.

c. Down the stairway to the 2 ft. elevation (fire zone 17-1a). Turn south and head along the Unit 1 charging pump cubicle walls to the cross-connect valve for Unit 1.

d. Head east along the walls of charging pump cubicles 1-CH-P-1C and 2-CH-P-1C to the Unit 2 charging pump discharge cross-connect valve located in fire zone 17-2a.

e. Retrace these steps to exit.

For a fire in fire zone 17-1b that disables all three of Unit 1's charging pumps, the cross-connect valves would be accessed as follows:

a. Control Room to the Unit 2 Cable Vault and Tunnel via the Emergency Switchgear Room. (However, Anti-C's should be obtained prior to entering the Auxiliary Building).

b. Enter the Auxiliary Building into fire zone 17-2b). Proceed west to the stairway adjacent to charging pump cubicle 2-CH-P-1A.

c. Down the stairway to the 2 ft. elevation (fire zone 17-2a). Turn south and head along the Unit 2 charging pump cubicle walls to the cross-connect valve for Unit 2.

d. Head west along the walls of charging pump cubicles 1-CH-P-1C and 2-CH-P-1C to the Unit 1 cross-connect valve located in fire zone 17-1a.

A fire in zones 17-1a or 17-2a would not disable all the pumps of one unit as explained in Exemption Request 1. Therefore, access routes for a fire in these two fire zones is unnecessary.

Both of these routes are illuminated with emergency lighting in accordance with Appendix R. These routes afford protection in an area separated by a 3-hour rated barrier (the CV/T) until actually entering the 13 ft. elevation of the Auxiliary Building. It is approximately 30 ft. from the Cable Vault/Tunnel door to the stairway down to the 2 ft. elevation. All travel will be in fire zones other than where the fire occurred.

Entering the 2 ft. elevation of the Auxiliary Building requires a full set of anti-contamination clothing to be worn. In addition, the operator should be prepared to encounter some smoke and heat conditions due to the open nature of the Auxiliary Building. Self-contained breathing apparatus (SCBA) should be carried to the point of entry into the 13 ft. elevation of the Auxiliary Building. The SCBA can be obtained in the Control Room or in the Health Physics area. As a safety precaution, the operator should wear the SCBA when entering the Auxiliary Building from both a smoke and airborne contamination standpoint. Operators are trained in the use of SCBAs. Radio communication between the operator and the Control Room or Fire Brigade Leader can be used to get information on the conditions in the Auxiliary Building.

3. Auxiliary Building Fires

The Auxiliary Building is a non-combustible structure (primarily concrete, especially on the lower two elevations). The combustible loading in the Auxiliary Building can be considered low as documented in the 1985 Combustible Loading Analysis for Surry Power Station.

It is important to consider the types of combustible and the contributions they will make in a postulated fire. The following combustibles are taken from those listed in the 1985 Combustible Loading Analysis for the Auxiliary Building for the 13 ft. and 2 ft. elevations.

a. Cable Insulation - Cable insulation makes up approximately 75% of the combustible loading on the 13 ft. elevation. The cable in the Auxiliary Building, although not all IEEE-383 qualified, does exhibit the inherent properties of cable which requires a substantial exposure fire for ignition and to provide sufficient heat input to sustain combustion.

   The cabling is located primarily at the ceiling level. Therefore, the heat and smoke generated by a cable insulation fire would be above the level the operator must travel to the cubicles.

b. Lube Oil - Virtually the entire combustible loading on the 2 ft. elevation and the remaining 25% of the combustible loading on the 13 ft. elevation is lube oil. The majority of the lube oil is contained in the charging pumps. Since each charging pump is in an individual cubicle (but is considered part of elevation 2 ft. when calculating combustible loading), this portion of the lube oil is not a factor. Lube oil for the CCW pumps is not under pressure and is in a lesser quantity than in the charging pumps. Transient lube oil is only brought in during an oil change for a specific pump and only in the quantity needed for that pump; however, it is included in the combustible loading calculations.

c. Class A Combustibles - Step-off pads and protective clothing along with maintenance supplies are the primary Class A combustible in the Auxiliary Building. The amount listed in the referenced analysis is during an outage when the transient combustible loading is at its peak.

d. Other Combustibles - There are several other combustibles (i.e., grease) in quantities so small (see the 1985 Combustible Loading Analysis) that they are insignificant.

The configuration of the Auxiliary Building will also help reduce the heat exposure to the operator. The Auxiliary Building has several open shafts and high ceilings that will allow heat and smoke to rise to the upper elevations away from the paths that the operator must take to reach the cubicles. There are numerous thick concrete shielding floors and walls. Although these walls may not be specifically fire rated, they are effective barriers to fire spread and will provide protection for the operators as well as the fire brigade. There are several openings to the exterior of the Auxiliary Building on upper elevations where smoke can be exhausted.

4. Station Resources

a. Detection and Suppression

There is a detection system in the Auxiliary Building (although it does not provide full area coverage, see Exemption Request I). The detectors are concentrated above cable trays and over safe shutdown components. These ionization type smoke detectors, annunciate in the Control Room. Detection will provide an early warning of a fire. There is normally personnel in the Auxiliary Building. Operators and Health Physics (H.P.) technicians as well as Security personnel make periodic rounds of the Auxiliary Building. Personnel in the Auxiliary Building will be able to detect a fire or confirm a detection alarm very quickly. This will enable the personnel in the Auxiliary Building (if trained), or the fire brigade, additional time to assemble and extinguish a fire.

Hose stations and portable fire extinguishers are provided throughout the Auxiliary Building.

b. Fire Brigade

Surry Power Station has a fire brigade that meets the criteria of Appendix A to Branch Technical Position APCSB 9.5-1 Section B-4 (August, 1976). The brigade has a minimum of five members including a trained brigade leader who, along with two of the other brigade members, are plant operators. In addition to the five assigned brigade members per shift, Surry has additional brigade members who may be available to fight fires.

The fire brigade is fully equipped with SCBA's, radios, fire fighting equipment, and detailed pre-fire plans.

The response time of the fire brigade obviously varies with the location of the fire. Response time is recorded as a critique item during fire drills. Experience has shown the response time to the Auxiliary Building to be 5 minutes or less for the arrival of the first brigade member. Due to the low level of combustibles and the detection system, the fire brigade should be able to quickly control a fire. Therefore, within 30 minutes, the fire brigade will be able to assemble, attack, and control or completely extinguish a fire.

The fire brigade will be in radio contact with the Control Room and most likely the operator who will access the valves. The fire brigade will be able to provide any assistance the operator needs in accessing the valves. This may include information on the fire location, quantities of heat and smoke, suggested access paths, or even hose stream protection of the path. Although credit cannot be taken under Appendix R, one of the operators on the fire brigade via instruction from the Control Room could access the cross-connect valves and operate the valves. This would not jeopardize the fire fighting activities since the time required to perform the operator action is less than 5 minutes.

c. Administrative Controls

Surry Power Station has a number of station policies and procedures that provide for fire prevention. Those with the greatest impact are:

1.) Flame and Welding permit and procedure

2.) Limits on storage and use of flammable and combustible liquids

3.) Limits on storage and use of transient combustibles

4.) Q.A. Inspections

While these procedures do not assure that fires will be prevented, they will reduce the likelihood and the potential fire effects should a fire occur.

CONCLUSION

An operator will be able to access the charging pump discharge cross-connect valves within 30 minutes of the loss of charging for one unit due to a fire-induced failure of all three charging pumps of one unit. Therefore, an operator will be able to restore charging to one unit from the other unit via the charging pump discharge cross-connect header to allow safe shutdown of the plant. The bases for this conclusion can be summarized as follows:

1. Based on the fire zone divisions, access pathways to the valves are available for a fire affecting either unit's charging pumps.

2. Both access routes have emergency lighting.

3. The operators are familiar with both routes and will be able to communicate with the fire brigade on conditions in the Auxiliary Building via portable radios.

4. Breathing apparatus is available to the operator.

5. The combustible loading in the Auxiliary Building is low, especially on the 2 ft. elevation.

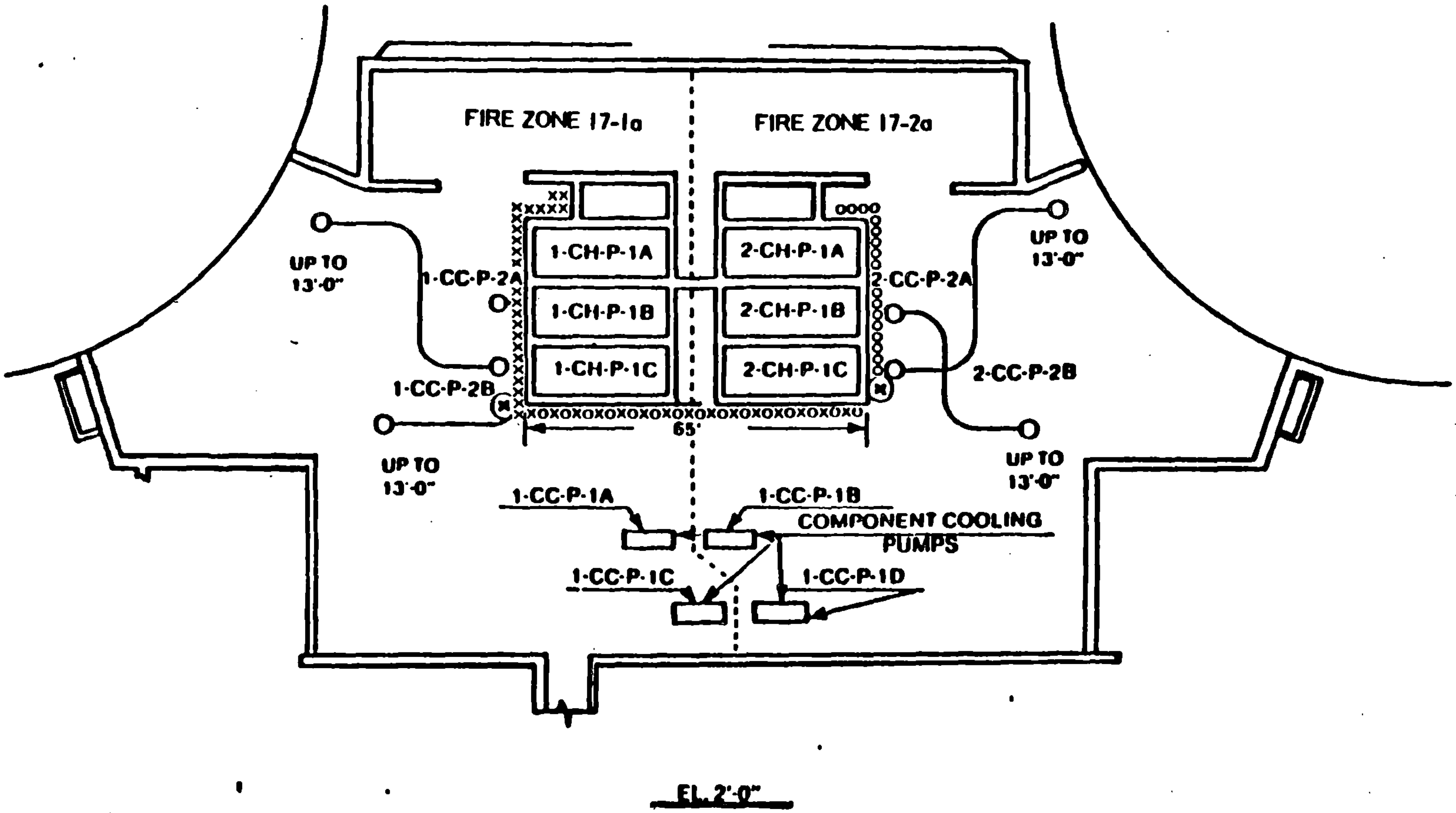
6. The main combustible on the 13 ft. elevation is primarily cable insulation located away from the access routes.

7. The main combustible on the 2 ft. elevation is lube oil which is contained within the charging pump cubicles and does not expose the access paths.

8. The Auxiliary Building is a non-combustible structure.

9. Ionization smoke detectors are installed on the 2 ft. and 13 ft. elevations of the Auxiliary Building in the vicinity of the charging and CCW pumps, and power cables. The detection annunciates in the Control Room.

10. The station fire brigade will assemble, and control or extinguish a fire in the vicinity of the access paths within 30 minutes and will be able to provide any protection needed for the operator.

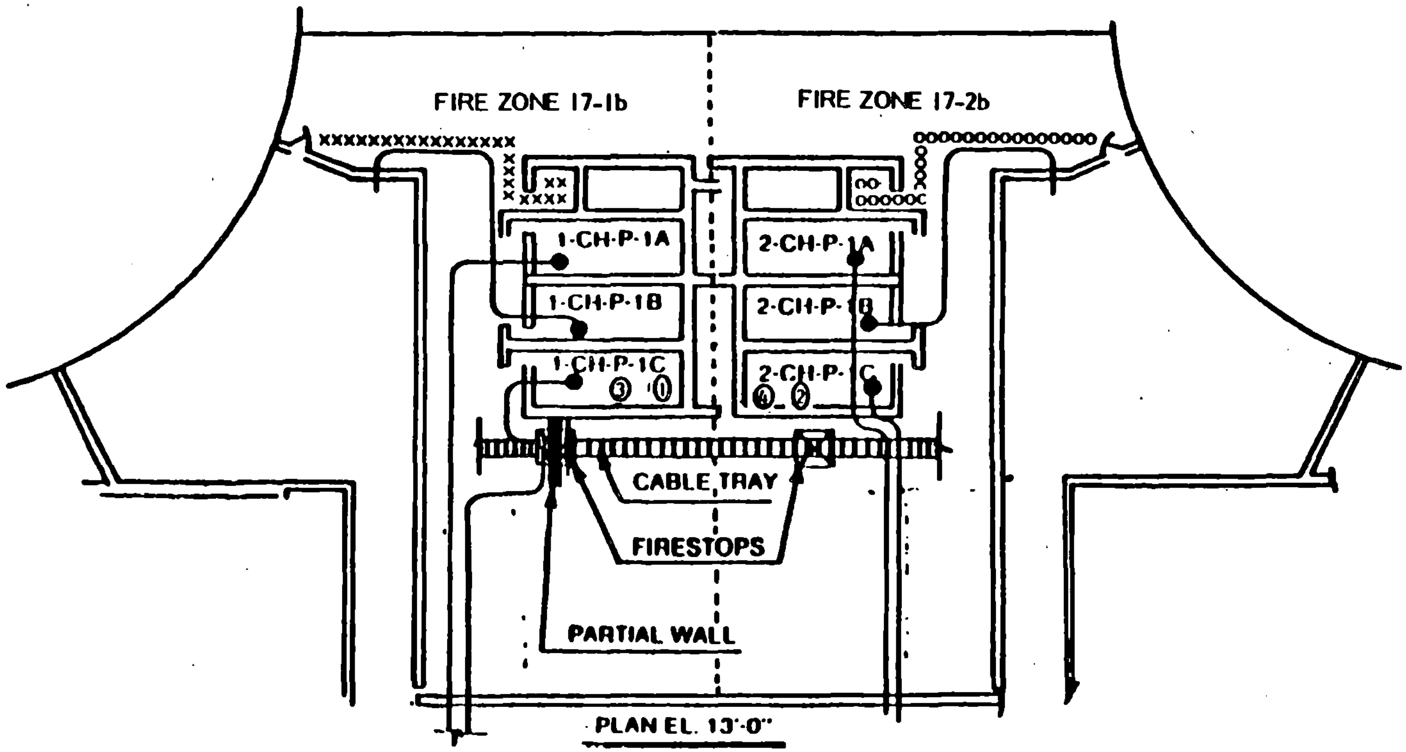


AUXILIARY BUILDING

NOTE:

(X) INDICATES THE LOCATION OF THE CHARGING PUMP CROSS-CONNECT VALVES.
xoxo - Common Access Paths
— — — REPRESENTS FIRE ZONE BOUNDARY
xxxx - Access Route to Valves for a Fire in Fire Zone 17-2b
oooo - Access Route to Valves for a Fire in Fire Zone 17-1b

VIRGINIA ELECTRIC & POWER COMPANY SURRY POWER STATION UNITS 1 & 2	FIRE AREA 17 AUXILIARY BUILDING ELEV. 2'-0"	FIGURE NO. 8-1



AUXILIARY BUILDING

(1)- LCV-1115B
(2)- LCV-1115D
(3)- LCV-2115B
(4)- LCV-2115D

---- REPRESENTS FIRE ZONE BOUNDARY

xxxx - Access Route to Valves for a Fire in Fire Zone 17-2b
oooo - Access Route to Valves for a Fire in Fire Zone 17-1b

VIRGINIA ELECTRIC & POWER COMPANY SURRY POWER STATION UNITS 1 & 2	FIRE AREA 17 AUXILIARY BUILDING ELEV. 13'-0"	FIGURE NO. 8-2