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**FEB 26 2001**

U.S. Nuclear Regulatory Commission  
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Washington, DC 20555

**SUSQUEHANNA STEAM ELECTRIC STATION  
REVISION 10 TO THE SUSQUEHANNA SES  
FIRE PROTECTION REVIEW REPORT  
PLA-5264**

**Docket Nos. 50-387  
and 50-388**

Enclosed is Revision No. 10 to the Susquehanna SES Fire Protection Review Report (FPRR). The entire text portions of the FPRR are being issued in this revision due to word processing conversions even though there are no changes in certain sections. A summary of the changes is provided below.

<b>FPRR SECTION, TABLE, FIGURE, OR DEVIATION REQUEST</b>	<b>DESCRIPTION OF CHANGE</b>
1.1, 1.2, 1.3, and 1.4	Revised to reflect Corporation name change.
2.16	Revised to reflect removal of the Control Structure and Reactor Building HVAC Systems from the Safe Shutdown Equipment List and Analysis.
3.1	Revised to reflect Corporation name change.
3.3.1	<ul style="list-style-type: none"><li>• Revised to reflect the position that automatic initiation of safety systems is not credited in the Appendix R Safe Shutdown Analysis and to account for changes in combustible loading resulting from considering Thermo-Lag a combustible.</li><li>• Revised to reflect removal of the Control Structure and Reactor Building HVAC Systems from the Safe Shutdown Equipment List and Analysis.</li></ul>

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FRR SECTION, TABLE, FIGURE, OR DEVIATION REQUEST	DESCRIPTION OF CHANGE
Table 3.3-1	Revised to reflect removal of the Control Structure and Reactor Building HVAC Systems from the Safe Shutdown Equipment List and Analysis.
3.4	Revised to reflect relocation of the fire protection system surveillances from the Technical Specifications to the Technical Requirements Manual.
4.0	Revised to reflect Corporation name change.
4.6	Revised the description of the Standpipes and Hose Stations.
4.10	Revised to clarify IEEE 383 flame test requirements for Non Class 1E cable.
Table 4.13-1	Revised to reflect the addition of communication jack plates in Fire Zones 0-27E and 0-27A
Table 5.0-1	<ul style="list-style-type: none"> <li>• Revised to reflect the addition of the Hydrogen Water Chemistry System. [Item D.2(b)]</li> <li>• Revised to clarify IEEE 383 flame test requirements for Non Class 1E cable. [Item D.2(c)]</li> <li>• Revised to reflect installation of fiber optic cables containing PVC. [Items D.2(c) and D.2(g)]</li> <li>• Revised the description of radio communication system channel configuration to add clarity and to describe the addition of a fifth channel repeater. [Item D.5(c)]</li> <li>• Revised the description of the Standpipes and Hose Stations. [Items E.3(d) and E.3(e)]</li> <li>• Revised to reflect Corporation name change.</li> </ul>
Table 6.1-1	Revised to reflect removal of the Control Structure and Reactor Building HVAC Systems from the Safe Shutdown Equipment List and Analysis.

FRR SECTION, TABLE, FIGURE, OR DEVIATION REQUEST	DESCRIPTION OF CHANGE
6.2.1 and 6.2.2	<ul style="list-style-type: none"> <li>Revised to reflect the removal of the containment instrument gas system valves from the safe shutdown equipment list and analysis.</li> <li>Revised to reflect removal of the Control Structure and Reactor Building HVAC Systems from the Safe Shutdown Equipment List and Analysis.</li> <li>Revised to reflect the extension of Automatic Preaction Sprinkler System PA-151 in Fire Zone 1-5A-W</li> </ul>
6.2.4, 6.2.7, and 6.2.8	Revised to reflect removal of the Control Structure and Reactor Building HVAC Systems from the Safe Shutdown Equipment List and Analysis.
6.2.9	<ul style="list-style-type: none"> <li>Revised to reflect the removal of the containment instrument gas system valves from the safe shutdown equipment list and analysis.</li> <li>Revised to reflect removal of the Control Structure and Reactor Building HVAC Systems from the Safe Shutdown Equipment List and Analysis.</li> <li>Revised to reflect the extension of preaction sprinkler system PA-251 into Fire Zone 2-5B and portions of Fire Zone 2-5A-S.</li> </ul>
6.2.10	<ul style="list-style-type: none"> <li>Revised to reflect the removal of the containment instrument gas system valves from the safe shutdown equipment list and analysis.</li> <li>Revised to reflect removal of the Control Structure and Reactor Building HVAC Systems from the Safe Shutdown Equipment List and Analysis.</li> </ul>
6.2.12	<ul style="list-style-type: none"> <li>Revised to reflect removal of the Control Structure and Reactor Building HVAC Systems from the Safe Shutdown Equipment List and Analysis.</li> <li>Revised to reflect the extension of preaction sprinkler system PA-251 into Fire Zone 2-5B and portions of Fire Zone 2-5A-S.</li> </ul>

FRR SECTION, TABLE, FIGURE, OR DEVIATION REQUEST	DESCRIPTION OF CHANGE
6.2.15 and 6.2.16	Revised to reflect removal of the Control Structure and Reactor Building HVAC Systems from the Safe Shutdown Equipment List and Analysis.
6.2.19	<ul style="list-style-type: none"> <li>• Revised to address elimination of Fire Area CS-8.</li> <li>• Revised the text of the section to address changes in combustible loading, fire detection equipment and fire protection equipment in the computer room (Fire Zone 0-24E) PGCC underfloor area due to the incorporation of Fire Area CS-8.</li> </ul>
6.2.20	Revised to reflect removal of the Control Structure and Reactor Building HVAC Systems from the Safe Shutdown Equipment List and Analysis.
6.2.21	Revised to clarify the location of Halon fire suppression capability in the safety related PGCC modules.
6.2.23	Revised to reflect the removal of the containment instrument gas system valves from the safe shutdown equipment list and analysis.
6.2.24	Revised to address elimination of Fire Area CS-8
6.2.25	<ul style="list-style-type: none"> <li>• Revised to reflect the removal of the containment instrument gas system valves from the safe shutdown equipment list and analysis.</li> <li>• Revised to reflect removal of the Control Structure and Reactor Building HVAC Systems from the Safe Shutdown Equipment List and Analysis.</li> </ul>
6.2.26	Revised to reflect the removal of the containment instrument gas system valves from the safe shutdown equipment list and analysis.

FRR SECTION, TABLE, FIGURE, OR DEVIATION REQUEST	DESCRIPTION OF CHANGE
6.2.27 6.2.28, 6.2.29, 6.2.30, 6.2.32, 6.2.34, 6.2.35, 6.2.36, 6.2-37, 6.2.38, 6.2.39, 6.2.40, 6.2.41, 6.2.42, and 6.2.43	Revised to reflect removal of the Control Structure and Reactor Building HVAC Systems from the Safe Shutdown Equipment List and Analysis.
6.2.44	<ul style="list-style-type: none"> <li>Revised to reflect removal of the Control Structure and Reactor Building HVAC Systems from the Safe Shutdown Equipment List and Analysis.</li> <li>Revised to clarify the location of Halon fire suppression capability in the safety related PGCC modules.</li> </ul>
6.2.47	<ul style="list-style-type: none"> <li>Revised to reflect the removal of the containment instrument gas system valves from the safe shutdown equipment list and analysis.</li> <li>Revised to clarify the location of Halon fire suppression capability in the safety related PGCC modules.</li> </ul>
6.2.48	Revised to reflect the removal of the containment instrument gas system valves from the safe shutdown equipment list and analysis.
6.2.49	<ul style="list-style-type: none"> <li>Revised to reflect the removal of the containment instrument gas system valves from the safe shutdown equipment list and analysis.</li> <li>Revised to reflect removal of the Control Structure and Reactor Building HVAC Systems from the Safe Shutdown Equipment List and Analysis.</li> <li>Revised to clarify the location of Halon fire suppression capability in the safety related PGCC modules.</li> </ul>
6.2.50 and 6.2.52	Revised to take credit for the availability of offsite power for safe shutdown Path 3 and to take credit for the availability of HPCI for safe shutdown in Fire Area D-1.
6.2.57 and 6.2.59	Revised to reflect the addition of the Hydrogen Water Chemistry System.

<b>FRRR SECTION, TABLE, FIGURE, OR DEVIATION REQUEST</b>	<b>DESCRIPTION OF CHANGE</b>
Table 6.1-1	Revised to address elimination of Fire Area CS-8 and the incorporation of Fire Area CS-8 into Fire Area CS-3.
Table 7.1-1	<ul style="list-style-type: none"> <li>Revised to reflect removal of the Control Structure and Reactor Building HVAC Systems from the Safe Shutdown Equipment List and Analysis.</li> <li>Revised to address elimination of Fire Area CS-8</li> </ul>
7.2	Revised to reflect removal of the Control Structure and Reactor Building HVAC Systems from the Safe Shutdown Equipment List and Analysis.
Deviation Request 4	Revised to reflect the extension of Automatic Preaction Sprinkler System PA-151 in Fire Zone 1-5A-W
Deviation Request 6	Revised to reflect the extension of preaction sprinkler system PA-251 into Fire Zone 2-5B and portions of Fire Zone 2-5A-S.
Deviation Request 9	Revised to reflect removal of the Control Structure and Reactor Building HVAC Systems from the Safe Shutdown Equipment List and Analysis.
Deviation Request 11	<ul style="list-style-type: none"> <li>Revised to reflect the extension of Automatic Preaction Sprinkler System PA-151 in Fire Zone 1-5A-W.</li> <li>Revised to reflect the extension of preaction sprinkler system PA-251 into Fire Zone 2-5B and portions of Fire Zone 2-5A-S.</li> </ul>
Deviation Request 12	Revised to reflect the extension of Automatic Preaction Sprinkler System PA-151 in Fire Zone 1-5A-W.
Deviation Request 16	Revised to reflect removal of the Control Structure and Reactor Building HVAC Systems from the Safe Shutdown Equipment List and Analysis.
Deviation Request 26	Revised to include Thermo-Lag as an intervening combustible in Fire Zone 2-3B-N.


FRR SECTION, TABLE, FIGURE, OR DEVIATION REQUEST	DESCRIPTION OF CHANGE
Deviation Request 27	<ul style="list-style-type: none"> <li>Revised to reflect the position that automatic initiation of safety systems is not credited in the Appendix R Safe Shutdown Analysis and to account for changes in combustible loading resulting from considering Thermo-Lag a combustible.</li> <li>Revised to reflect replacement of the Unit 1 Core Spray/RHR/LPCI low-pressure permissive pressure switch.</li> </ul>
Deviation Request 29	<ul style="list-style-type: none"> <li>Revised to reflect installation of fiber optic cables containing PVC.</li> <li>Revised to reflect Thermo-Lag abandonment.</li> </ul>
Deviation Request 30	Revised to reflect removal of the Control Structure and Reactor Building HVAC Systems from the Safe Shutdown Equipment List and Analysis.
Deviation Request 33	Revised to reflect Corporation name change.
Deviation Request 36	Revised to reflect removal of the Control Structure and Reactor Building HVAC Systems from the Safe Shutdown Equipment List and Analysis.
Deviation Request 42	Revised to reflect Thermo-Lag abandonment.

FPRR SECTION, TABLE, FIGURE, OR DEVIATION REQUEST	DESCRIPTION OF CHANGE
Section 8 Figures	<ul style="list-style-type: none"><li>• General revision of FPRR drawings to reflect updating and plant modifications, editorial changes, and administrative changes.</li><li>• Revised Drawing No. E-1050002 to reflect the addition of the Hydrogen Water Chemistry System.</li><li>• Revised Drawing No. E-205985 to reflect the addition of a new fire damper in the Turbine Building supply duct for Unit 2.</li><li>• Revised Drawing No. E-205993 to reflect upgrading the existing fire barrier enclosures to the 125 VDC distribution panels.</li><li>• Revised to reflect installation of fiber optic cables containing PVC.</li><li>• Revised to reflect the extension of Fire Area CS-3.</li><li>• Revised to include Thermo-Lag as an intervening combustible in Fire Zone 2-3B-N.</li></ul>

PPL has determined that the above changes do not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire. Therefore, these changes may be implemented without prior NRC approval in accordance with License Conditions 2.C.(6) for NPF-14 and 2.C.(3) for NPF-22.

If you have any questions regarding this submittal, please contact Mr. C. T. Coddington at (610) 774-4019.

Sincerely,

  
R. G. Byram  
Enclosure

Copy: Regional Administrator - Region I  
Mr. S. L. Hansell, NRC Sr. Resident Inspector  
Mr. R. G. Schaaf, NRC Sr. Project Manager



bcc:	F. G. Butler	GENA63	w/o
	S. F. Davis	NUCSA2	w/o
	C. T. Coddington	GENA61	w/a
	T. A. Gorman	GENA63	w/o
	F. S. Gruscavage	NUCSA2	w/o
	R. R. Sgarro	GENA61	w/o
	T. G. Wales	GENA63	w/o
	Licensing Files	GENA61	w/a (w/org. attached NDAP-QA-0729-1)
	Nuclear Records	GENA62	w/a (w/attached NDAP-QA-0729-1)
	Attn: P. Brown		

**FIRE PROTECTION REV. 10 REMOVE/INSERT**

<b><u>Section</u></b>	<b><u>Title</u></b>	<b><u>Remove</u></b>	<b><u>Insert</u></b>
	<b>COVER SHEET</b>	1 of 1	1 of 1
	<b>LIST OF EFFECTIVE SECTIONS</b>	LEP 1 thru LEP 29	FPRR/LOES 1 thru 20
	<b>SUMMARY TABLE OF CONTENTS</b>	1 and 2	1 and 2
<b>1.0</b>	<b>INTRODUCTION</b>		
1.1	Objective	1.1-1	1.1-1
1.2	Background	1.2-1	1.2-1
1.3	Philosophy	1.3-1	1.3-1
1.4	Fire Protection Program	1.4-1 thru 1.4-6	1.4-1 thru 1.4-5
1.5	Content and Format	1.5-1 and 1.5-2	1.5-1
<b>2.0</b>	<b>DEFINITIONS</b>	2.0-1 thru 2.0-7	2.0-1 thru 2.0-5
<b>3.0</b>	<b>SAFE SHUTDOWN ANALYSIS</b>		
3.1	Introduction	3.1-1	3.1-1
Table 3.1-1	Appendix R Compliance Flow Chart	1 of 1	1 of 1
3.2	Criteria	3.2-1 thru 3.2-4	3.2-1 thru 3.2-3
3.3	Methodology	3.3-1 thru 3.3-16	3.3-1 thru 3.3-10
Table 3.3-1	Appendix R Safe Shutdown Analysis Safe Shutdown Paths	1 thru 3	1 and 2
3.4	Long Term Compliance	3.4-1	3.4-1
<b>4.0</b>	<b>FIRE PROTECTION SYSTEM DESCRIPTION</b>	4.0-1	4.0-1
4.1	Fire Protection Water Supply Systems	4.1-1 thru 4.1-3	4.1-1 and 4.1-2
4.2	Automatic Wet Pipe Sprinkler Systems	4.2-1	4.2-1
4.3	Dry Pipe Sprinkler Systems	4.3-1	4.3-1
4.4	Automatic Preaction Sprinkler Systems	4.4-1	4.4-1
4.5	Deluge Systems	4.5-1	4.5-1
4.6	Wet Standpipes and Hose Stations	4.6-1	4.6-1
4.7	Portable Fire Extinguishers	4.7-1	4.7-1
4.8	Carbon Dioxide Systems	4.8-1	4.8-1
4.9	Halon Extinguishing Systems	4.9-1	4.9-1
4.10	Insulation and Jacketing of Cable	4.10-1	4.10-1

**FIRE PROTECTION REV. 10 REMOVE/INSERT**

<u>Section</u>	<u>Title</u>	<u>Remove</u>	<u>Insert</u>
4.11	Raceway Wrapping	4.11-1	4.11-1
4.12	Fire Detection and Alarm System	4.12-1 and 4.12-2	4.12-1
4.13	Appendix R Voiced Powered Communication System	4.13-1	4.13-1
Table 4.13-1	Jackplate Locations	1 of 1	1 of 1
<b>5.0</b>	<b>COMPARISON OF SUSQUEHANNA SES DESIGN AND FIRE PROTECTION FEATURES TO REGULATORY REQUIREMENTS</b>		
		5.0-1	5.0-1
Table 5.0-1	Susquehanna SES as Compared with Branch Technical Position 9.5-1 Appendix A, Rev. 0	1 thru 52	1 thru 46
Table 5.0-2	Comparison with 10CFR50 Appendix R	1 thru 7	1 thru 7
<b>6.0</b>	<b>FIRE HAZARDS ANALYSIS</b>		
6.1	Introduction	6.1-1 thru 6.1-8	6.1-1 thru 6.1-6
Table 6.1-1	Susquehanna SES Fire Areas	1 thru 7	1 thru 4
<b>6.2</b>	<b>FIRE AREA DESCRIPTION</b>		
		6.2-1 thru 6.2-205	6.2-1 thru 6.2-126
<b>7.0</b>	<b>DEVIATION REQUESTS</b>		
7.1	Introduction	7.1-1	7.1-1
Table 7.1-1	Appendix R - Deviation Request Reference Matrix	1 thru 6	1 thru 6
<b>7.2</b>	<b>DEVIATION REQUEST INDEX</b>		
		7.2-1 thru 7.2-3	7.2-1 and 7.2-2
DR1	Deviation Request 1 Withdrawn	DR1-1	DR1-1
DR2	Appendix R - Suppression Pool Temperature Indication	DR2-1 thru DR2-4	DR2-1 thru DR2-3
DR3	Appendix R - Fire Doors-Non-Rated	DR3-1 thru DR3-3	DR3-1 DR3-2

**FIRE PROTECTION REV. 10 REMOVE/INSERT**

<u>Section</u>	<u>Title</u>	<u>Remove</u>	<u>Insert</u>
	Appendix A - Deviation Request No. 3 Fire Protection Program Concern #1 Attachment 1	DR3A1-1	DR3A1-1
	Appendix A - Deviation Request No. 3 Fire Protection Program Attachment 2	DR3A2-1	DR3A2-1
	Appendix A - Deviation Request No. 3 Fire Protection Program Attachment 3	DR3A3-1	DR3A3-1
	Technical Report - Cover Sheet "Evaluation of Selected Fire Door and Door Frame Assemblies" (Supplement 2) by Samuel Knight Factory Mutual Research / June 1986	Cover Sheet	Cover Sheet
	Appendix A - Deviation Request No. 3 Fire Protection Program Attachment 4	DR3A4-1	DR3A4-1
	Appendix A - Deviation Request No. 3 Fire Protection Program Attachment 5	DR3A5-1	DR3A5-1
	Appendix A - Deviation Request No. 3 Fire Protection Program Attachment 6	DR3A6-1	DR3A6-1
Table DR3-1	Fire Doors - Non-Rated	Page 1	Table DR3-1 1 of 1 Rev. 10
DR4	Appendix R - Deviation Request No. 4 Wraparound Area	DR4-1 thru DR4-6	DR4-1 thru DR4-4
DR5	Deviation Request 5 Withdrawn	DR5-1	DR5-1

**FIRE PROTECTION REV. 10 REMOVE/INSERT**

<u>Section</u>	<u>Title</u>	<u>Remove</u>	<u>Insert</u>
DR6	Appendix R - Deviation Request No. 6 Non Fireproofed Structural Steel	DR6-1 thru DR6-5	DR6-1 thru DR6-4
<b>NOTE: FOR DR6 DO NOT REMOVE FIGURES UNLESS NOTED ON REMOVE/INSERT SHEET</b>			
	Unit 1 Fire Rated Floor Slab Above Fire Zone 1-1F	DR6-6	DR6-5 DR6-6
	Unit 1 Fire Rated Floor Slab Above Fire Zone 1-1E	DR6-7	DR6-7 DR6-8
	Unit 1 Fire Rated Floor Slab Above Fire Zone 1-3A	DR6-8 DR6-9	DR6-9 DR6-10
	Unit 1 Fire Rated Floor Slab Above Fire Zone 1-3B-W	DR6-10	DR6-11 DR6-12
	Unit 1 Fire Rated Floor Slab Above Fire Zone 1-3B-W	DR6-11	DR6-13 DR6-14
	Unit 1 Fire Rated Floor Slab Above Fire Zone 1-4A-W	DR6-12	DR6-15 DR6-16
	Unit 1 Fire Rated Floor Slab Above Fire Zones 1-4A-W and 1-4A-N	DR6-13	DR6-17 DR6-18
	Unit 1 Fire Rated Floor Slab Above Fire Zones 1-4A-W and 1-4A-S	DR6-14	DR6-19 DR6-20
	Unit 1 Fire Rated Floor Slab Above Fire Zones 1-4A-W and 1-4A-N	DR6-15	DR6-21 DR6-22
	Unit 1 Fire Rated Floor Slab Above Fire Zone 1-4G	DR6-16	DR6-23 DR6-24
	Unit 1 Fire Rated Floor Slab Above Fire Zone 1-5A-S	DR6-17	DR6-25 DR6-26

**FIRE PROTECTION REV. 10 REMOVE/INSERT**

<u>Section</u>	<u>Title</u>	<u>Remove</u>	<u>Insert</u>
<b>NOTE: FOR DR6 DO NOT REMOVE FIGURES UNLESS NOTED ON REMOVE/INSERT SHEET</b>			
	Unit 1 Fire Rated Floor Slab Above Fire Zone 1-5B	DR6-18 DR6-19	DR6-27 DR6-28
	Unit 2 Fire Rated Floor Slab Above Fire Zones 2-1A, 1C, 1D	DR6-20	DR6-29 DR6-30
	Unit 2 Fire Rated Floor Slab Above Fire Zone 2-1F	DR6-21	DR6-31 DR6-32
	Unit 2 Fire Rated Floor Slab Above Fire Zone 2-1E	DR6-22	DR6-33 DR6-34
	Unit 2 Fire Rated Floor Slab Above Fire Zone 2-3B-N	DR6-23	DR6-35 DR6-36
	Unit 2 Fire Rated Floor Slab Above Fire Zone 2-3B-W	DR6-24	DR6-37 DR6-38
	Unit 2 Fire Rated Floor Slab Above Fire Zone 2-3B-W	DR6-25	DR6-39 DR6-40
	Unit 2 Fire Rated Floor Slab Above Fire Zones 2-4A-S and 2-4A-W	DR6-26	DR6-41 DR6-42
	Unit 2 Fire Rated Floor Slab Above Fire Zone 2-4A-W	DR6-27	DR6-43 DR6-44
	Unit 2 Fire Rated Floor Slab Above Fire Zones 2-4A-W and 2-4A-S	DR6-28	DR6-45 DR6-46
	Unit 2 Fire Rated Floor Slab Above Fire Zones 2-4A-W and 2-4A-N	DR6-29	DR6-47 DR6-48
	Unit 2 Fire Rated Floor Slab Above Fire Zone 2-4G	DR6-30 DR6-31	DR6-49 DR6-50
	Unit 2 Fire Rated Floor Slab Above Fire Zone 2-5A-N	DR6-32 DR6-33	DR6-51 DR6-52

**FIRE PROTECTION REV. 10 REMOVE/INSERT**

<u>Section</u>	<u>Title</u>	<u>Remove</u>	<u>Insert</u>
<b>NOTE: FOR DR6 DO NOT REMOVE FIGURES UNLESS NOTED ON REMOVE/INSERT SHEET</b>			
	Unit 2 Fire Rated Floor Slab Above Fire Zones 2-5C, 2-5A-S, 2-5B	DR6-34 DR6-35	DR6-53 DR6-54
	Drawing C-206015	Sheet 1 - Rev. 0	Sheet 1 - Rev. 1
	Drawing C-206015	Sheet 2 - Rev. 0	Sheet 2 - Rev. 1
	Drawing C-206015	Sheet 3 - Rev. 0	Sheet 3 - Rev. 1
	Unit 2 Fire Rated Floor Slab Above Fire Zone 2-6A	DR6-36	DR6-55
DR6	Fire Protection Program - Appendix R - Non FireProofed Structural Steel "Summary Report for Structural Steel Evaluation" Unit 1 & Unit 2 Reactor Buildings Revision 2, 10/87	Cover thru DR6SR-25	DR6SR-1 thru DR6SR-22
Table DR6-1		DR6-1 1 and 2 05/93 - Rev. 4	Table DR6-1 1 of 1 Rev.10
Table DR6-2		DR6-2 1 and 2	Table DR6-2 1 of 1 - Rev.10
	Appendix A - Figure	05/93 - Rev. 4	DR6APPA-1
	Appendix B - References	05/93 - Rev. 4	DR6APPB-1
	Summary Table of Contents	05/93 - Rev. 4	Rev. 10
DR7	Appendix R - Deviation Request 7 Fire Spread Limitations	DR7-1 thru DR7-3	DR7-1 DR7-2
DR8	Appendix R - Deviation Request 8 One Hour Fire Barrier Wrap With Limited Suppression	DR8-1 DR8-2	DR8-1 DR8-2

**FIRE PROTECTION REV. 10 REMOVE/INSERT**

<u>Section</u>	<u>Title</u>	<u>Remove</u>	<u>Insert</u>
DR9	Deviation Request 9 Withdrawn	DR9-1 DR9-2	DR9-1
DR10	Deviation Request 10 Withdrawn	DR10-1	DR10-1
DR11	Appendix R - Deviation Request 11 HVAC Penetrations Reactor Building Fire Walls	DR11-1 thru DR11-8	DR11-1 thru DR11-6
<b>NOTE: FOR DR11 DO NOT REMOVE FIGURES UNLESS NOTED ON REMOVE/INSERT SHEET</b>			
	Appendix R - Deviation Request 11 HVAC Penetrations Reactor Building Fire Walls	DR11-9 thru DR11-12	DR11-7 DR11-8
	Appendix R - Deviation Request 11 HVAC Penetrations Reactor Building Fire Walls	DR11-13 thru DR11-16	DR11-9 DR11-10
	Appendix R - Deviation Request 11 HVAC Penetrations Reactor Building Fire Walls	DR11-17 thru DR11-19	DR11-11 DR11-12
	Appendix R - Deviation Request 11 HVAC Penetrations Reactor Building Fire Walls	DR11-20 thru DR11-23	DR11-13 DR11-14
	Appendix R - Deviation Request 11 HVAC Penetrations Reactor Building Fire Walls	DR11-24 thru DR11-26	DR11-15 DR11-16
	Appendix R - Deviation Request 11 HVAC Penetrations Reactor Building Fire Walls	DR11-27 thru DR11-29	DR11-17 DR11-18
	Appendix R - Deviation Request 11 HVAC Penetrations Reactor Building Fire Walls	DR11-30 thru DR11-32	DR11-19 DR11-20



**FIRE PROTECTION REV. 10 REMOVE/INSERT**

<u>Section</u>	<u>Title</u>	<u>Remove</u>	<u>Insert</u>
<b>NOTE: FOR DR11 DO NOT REMOVE FIGURES UNLESS NOTED ON REMOVE/INSERT SHEET</b>			
	Appendix R - Deviation Request 11 HVAC Penetrations Reactor Building Fire Walls	DR11-33 thru DR11-35	DR11-21 DR11-22
	Appendix R - Deviation Request 11 HVAC Penetrations Reactor Building Fire Walls	DR11-36 thru DR11-38	DR11-23 DR11-24
	Appendix R - Deviation Request 11 HVAC Penetrations Reactor Building Fire Walls	DR11-39 thru DR11-41	DR11-25 DR11-26
	Appendix R - Deviation Request 11 HVAC Penetrations Reactor Building Fire Walls	DR11-42 thru DR11-44	DR11-27 DR11-28
	Appendix R - Deviation Request 11 HVAC Penetrations Reactor Building Fire Walls	DR11-45 thru DR11-48	DR11-29 DR11-30
	Appendix R - Deviation Request 11 HVAC Penetrations Reactor Building Fire Walls	DR11-49 thru DR11-51	DR11-31 DR11-32
	Appendix R - Deviation Request 11 HVAC Penetrations Reactor Building Fire Walls	DR11-52 thru DR11-54	DR11-33 DR11-34
	Appendix R - Deviation Request 11 HVAC Penetrations Reactor Building Fire Walls	DR11-55 thru DR11-57	DR11-35 DR11-36
	Appendix R - Deviation Request 11 HVAC Penetrations Reactor Building Fire Walls	DR11-58 thru DR11 60	DR11-37 DR11-38

**FIRE PROTECTION REV. 10 REMOVE/INSERT**

<u>Section</u>	<u>Title</u>	<u>Remove</u>	<u>Insert</u>
<b>NOTE: FOR DR11 DO NOT REMOVE FIGURES UNLESS NOTED ON REMOVE/INSERT SHEET</b>			
	Appendix R - Deviation Request 11 HVAC Penetrations Reactor Building Fire Walls	DR11-61 thru DR11 63	DR11-39 DR11-40
	Appendix R - Deviation Request 11 HVAC Penetrations Reactor Building Fire Walls	DR11-64 thru DR11 66	DR11-41 DR11-42
	Appendix R - Deviation Request 11 HVAC Penetrations Reactor Building Fire Walls	DR11-67 thru DR11 69	DR11-43 DR11-44
Table DR11-1		DR11-1 03/94 - Rev. 5	DR11-1 1 of 1 - Rev.10
DR12	Appendix R - Deviation Request 12 Fire Barriers Without Fire Dampers in Vertical Ventilation Duct Penetrations	DR12-1 thru DR12-5	DR12-1 thru DR12-4
<b>NOTE: FOR DR12 DO NOT REMOVE FIGURES UNLESS NOTED ON REMOVE/INSERT SHEET</b>			
	Appendix R - Deviation Request 12 Fire Barriers Without Fire Dampers in Vertical Ventilation Duct Penetrations	DR12-6 thru DR12-8	DR12-5 DR12-6
	Appendix R - Deviation Request 12 Fire Barriers Without Fire Dampers in Vertical Ventilation Duct Penetrations	DR12-9 thru DR12-11	DR12-7 DR12-8
	Appendix R - Deviation Request 12 Fire Barriers Without Fire Dampers in Vertical Ventilation Duct Penetrations	DR12-12 thru DR12-14	DR12-9 DR12-10
	Appendix R - Deviation Request 12 Fire Barriers Without Fire Dampers in Vertical Ventilation Duct Penetrations	DR12-15 thru DR12-17	DR12-11 DR12-12

**FIRE PROTECTION REV. 10 REMOVE/INSERT**

<u>Section</u>	<u>Title</u>	<u>Remove</u>	<u>Insert</u>
<b>NOTE: FOR DR12 DO NOT REMOVE FIGURES UNLESS NOTED ON REMOVE/INSERT SHEET</b>			
	Appendix R - Deviation Request 12 Fire Barriers Without Fire Dampers in Vertical Ventilation Duct Penetrations	DR12-18 thru DR12-20	DR12-13 DR12-14
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DR16	Deviation Request 16 Withdrawn	DR16-1 thru DR16-5	DR16-1

**FIRE PROTECTION REV. 10 REMOVE/INSERT**

<u>Section</u>	<u>Title</u>	<u>Remove</u>	<u>Insert</u>
	Drawing C-213433	Sheet 1 - Rev. 1	
	Drawing C-213433	Sheet 2 - Rev. 0	
	Drawing C-213434	Sheet 1 - Rev. 0	
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DR19	Appendix R - Deviation Request 19 Incomplete Fire Suppression And Fire Detection In Diesel Generator Fire Areas	DR19-1 DR19-2	DR19-1
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DR23	Appendix R - Deviation Request 23 Control Structure Fire Area CS-9 Partial Fire Suppression	DR23-1 thru DR23-3	DR23-1 DR23-2
DR24	Appendix R - Deviation Request 24 Automatic Fire Suppression in Fire Zone 2-5D	DR24-1 thru DR24-5	DR24-1 thru DR24-4
DR25	Appendix R - Deviation Request 25 Automatic Fire Suppression and Intervening Combustibles in Fire Zone 1-3A	DR25-1 thru DR25-5	DR25-1 thru DR25-3
DR26	Appendix R - Deviation Request 26 Separation of Redundant Safe Shutdown Capability in Fire Zone 2-3B-N	DR26-1 thru DR26-7	DR26-1 thru DR26-7

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<u>Section</u>	<u>Title</u>	<u>Remove</u>	<u>Insert</u>
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DR27	Appendix R - Deviation Request 27 Nuclear Boiler Instrumentation in Fire Zone 1-5A-S	DR27-1 thru DR27-6	DR27-1 thru DR27-5
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DR36	Deviation Request 36 Withdrawn	DR36-1 thru DR36-3	DR36-1
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DR37	Appendix R - Deviation Request 37 Control Room Raised Floor and Control Structure Cable Chase Fire Protection	DR37-1 thru DR37-5	DR37-1 thru DR37-4
DR38	Appendix R - Deviation Request 38 Protection of Redundant Safe Shutdown Raceways in the Unit 2 Main Steam Pipeway	DR38-1 thru DR38-3	DR38-1 thru DR38-3
DR39	Appendix R - Deviation Request 39 Category I Components in Fire Zones 1-6D and 2-6D	DR39-1 thru DR39-3	DR39-1 thru DR39-3
DR40	This Page Intentionally Left Blank	DR40-1	DR40-1
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<u>Section</u>	<u>Title</u>	<u>Remove</u>	<u>Insert</u>
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E-205951	SSES Unit 1 Reactor Building Fire Zone Plan of Elevation 683'-0"	Sheet 1 - Rev. 5 -----	Sheet 1 - Rev. 7 Sheet 2 - Rev.11
E-205952	SSES Unit 1 Reactor Building Fire Zone Plan of Elevation 719'-1"	Sheet 1 - Rev. 5 -----	Sheet 1 - Rev. 7 Sheet 2 - Rev. 4
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E-205968	SSES Units 1 & 2 Reactor Building Fire Zone Section D-D	Sheet 1 - Rev. 2	Sheet 1 - Rev. 6
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**FIRE PROTECTION REV. 10 REMOVE/INSERT**

<u>Section</u>	<u>Title</u>	<u>Remove</u>	<u>Insert</u>
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**PPL SUSQUEHANNA, LLC**

**SUSQUEHANNA STEAM ELECTRIC STATION  
UNITS 1 & 2**

**FIRE PROTECTION REVIEW REPORT  
(FPRR)**

**THIS DOCUMENT HAS BEEN UPDATED**

**TO INCLUDE**

**REVISIONS THROUGH 10**

**SUSQUEHANNA STEAM ELECTRIC STATION**  
**LIST OF EFFECTIVE SECTIONS (FIRE PROTECTION REVIEW REPORT)**

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**BEFORE THE  
UNITED STATES NUCLEAR REGULATORY COMMISSION**

In the Matter of

:

PPL Susquehanna, LLC

:

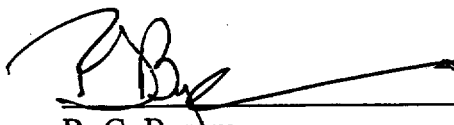
Docket No. 50-387  
and 50-388

**REVISION 10 TO THE SUSQUEHANNA SES  
FIRE PROTECTION REVIEW REPORT  
UNIT NO. 1 AND 2**

PPL Susquehanna, LLC, hereby files Revision 10 to its Fire Protection Review Report dated January 18, 1978.

PPL Susquehanna, LLC

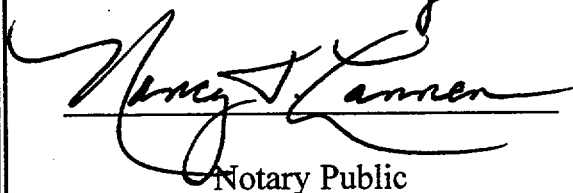
By:



R. G. Byram

Sr. Vice-President and Chief Nuclear Officer

Sworn to and subscribed before me  
this 26<sup>th</sup> day of February, 2001.

  
Notary Public

Notarial Seal  
Nancy J. Lannen, Notary Public  
Allentown, Lehigh County  
My Commission Expires June 14, 2004

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## **1.0 INTRODUCTION**

### **1.1 OBJECTIVE**

This Fire Protection Review Report (FPRR) submitted by PPL Susquehanna, LLC (PPL) describes the fire protection features which ensure the capability to achieve and maintain the cold (safe) shutdown of Susquehanna SES Units 1 and 2 and demonstrates compliance to the requirements of Appendix A to Branch Technical Position Auxiliary Power Conversion Systems Branch 9.5-1 (BTP APCSB 9.5-1); 10CFR50 Appendix R Sections III.G, III.J, III.L and III.O; 10CFR50.48; and General Design Criterion 3 of Appendix A to 10CFR50.

## 1.2 BACKGROUND

In September of 1976, PPL was informed by the NRC that the guidelines in Appendix A to BTP APCS 9.5-1 would be used by the NRC to evaluate the fire protection program at Susquehanna SES. Additionally, PPL was requested to provide a fire hazards analysis that divided the plant into distinct fire areas and to show that redundant safety systems required to achieve and maintain cold shutdown are adequately protected against fire damage. By early 1980, most of the aspects of Appendix A had been implemented at Susquehanna. In November, 1980, the NRC issued Appendix R to 10CFR50.

Appendix R was originally intended as a mechanism to close out a limited number of open issues for a limited set of plants. PPL agreed to comply with Sections III.G, III.J and III.O which was applied to all plants. As a result of our analysis compliance to Section III.L is also shown.

### 1.3 PHILOSOPHY

It is PPL's corporate philosophy that fire protection be provided for all company facilities in order to protect its employees and facilities as well as the general public from the effects of a fire. Subsequently, proper fire protection was an original design objective for Susquehanna SES. In addition to fire protection design features which would insure a safe and reliable facility, further design and programmatic requirements were necessary to prevent damage to those systems and components essential to the safe operation and safe shutdown of the station as well as the control of any radiological release from the station.

It is PPL's philosophy that in the event of a fire, Susquehanna SES Units 1 and 2 will be operated in accordance with symptom based Emergency Operating Procedures and Off Normal Procedures.

This Fire Protection Review Report primarily addresses PPL's compliance to the licensing and regulatory requirements which must be met in order to demonstrate the safe shutdown capability of both reactor units in the event of a design basis fire and to control the release of any radioactive elements from the station.

While Appendix A addresses the fire protection program as a whole, Appendix R requirements more specifically address the capability of both reactors to achieve and maintain a safe shutdown condition. Therefore, where the requirements of Appendix A and Appendix R overlapped, the Appendix R requirements govern since they most directly affect safe shutdown.



## 1.4 FIRE PROTECTION PROGRAM

### 1.4.1 Initial Implementation

Bechtel Power Corporation was the architect/engineer for Susquehanna SES and provided the fire protection engineers and consultants to develop the design concept, preparation of specifications, and selection of experienced fire protection contractors during plant construction. Bechtel has designed fire protection systems for several operating nuclear plants and employed a specialized staff that monitored the latest in fire protection methods.

As the plant progressed from a construction to an operational mode, PPL took full responsibility of the fire protection program. Responsibility for the fire protection program is vested in PPL managerial personnel in the same manner as other operating and design responsibilities.

### 1.4.2 Compliance

The fire protection program is implemented through approved specification, drawings, and procedures which are generated and controlled under the PPL Operational Quality Assurance Program.

PPL's long term compliance program for fire protection is an integral part of the design control process and assures that present plant fire protection features and hazard configurations will not be degraded by the implementation of a design change. Plant procedures control the use and storage of combustible materials. Design specifications and plant procedures provide for the periodic surveillance of required fire protection features. The combustible loading analysis is modified through the design control process.

Through this controlled, programmatic approach, the fire protection features at Susquehanna SES are assured to maintain their integrity as plant operation continues.

### 1.4.3 Personnel/Training

#### 1.4.3.1 Fire Protection Staff

PPL employs qualified personnel to ensure an adequate fire protection program is provided and maintained. The Site Fire Protection Engineer shall be a qualified fire protection engineer with suitable background experience to meet the job requirements. This will be supplemented with appropriate training from vendor training schools and state fire fighting schools as necessary to carry out the job responsibilities. Other personnel who are assigned fire protection duties will receive the necessary training to perform their assigned functions. Training for the fire protection staff shall include the following as necessary:

- a) design and maintenance of fire detection, suppression, and extinguishing systems.
- b) fire prevention techniques and procedures.
- c) training and manual fire fighting techniques and procedures for plant personnel and fire brigade.

#### 1.4.3.2 Other Station Employees

Instruction shall be provided for all employees with an unescorted security clearance and shall be repeated on a two year cycle. The instruction shall include, as appropriate, the fire protection program, recognizing the station emergency alarm sirens, and response to a fire related incident, including reporting a fire and evacuating the area.

Instruction shall be provided for security personnel that addresses entry control procedures for outside fire departments and other emergency response agencies, crowd control for personnel exiting the station, and procedures for reporting potential fire hazards observed when touring the facility.

Instruction shall be provided to all non fire brigade shift personnel to familiarize them with fire brigade activities and responsibilities.

Instruction shall be provided, as appropriate, to those personnel responsible for performing the inspection and maintenance of fire protection equipment.

Employees (when present at the time of a drill) shall participate in a fire exit drill to familiarize them with the evacuation routes and procedures for the individual office/administrative buildings on site. Fire exit drills should be held annually.

#### 1.4.3.3 Fire Brigade

- 1) Instruction
  - a) Instruction in the topics listed in (d) below shall be administered to individuals as required to supplement previous experience and training prior to assignment as a fire brigade member.
  - b) Refresher instruction shall be provided to all fire brigade members on a regularly scheduled basis of not less than four sessions a year. The sessions will be repeated at a frequency of not more than 2 years.
  - c) The instruction shall be provided by qualified individuals, knowledgeable and experienced in fighting the types of fires that could occur in the plant, and in using the types of equipment provided in the plant. Members of the Fire Protection staff may also conduct this training.

- d) The scope of this instruction should include the following items:
- i) An identification of the fire hazards and associated types of fires that could occur in the plant, and an identification of the location of the hazards, including areas where breathing apparatus is required, regardless of the size of the fire.
  - ii) Identification of the location of installed and portable firefighting equipment in each area, and familiarization with layout of the plant including access and egress routes to each area.
  - iii) The proper use of available fire fighting equipment, and the correct method of fighting each type of fire. The types of fires covered shall include electrical fires, fires in cables and cable trays, hydrogen fires, flammable liquids, waste/debris fires, and record file fires.
  - iv) Indoctrination in the plant fire fighting plan, with coverage of each individual's responsibilities, including changes thereto.
  - v) The proper use of breathing equipment, communication, lighting, and portable ventilation equipment.
  - vi) A detailed review of the fire fighting procedures and procedure changes, with particular emphasis on what equipment must be used in particular areas.
  - vii) A review of latest modifications, additions, or changes to the facility or procedures which affect the fire fighting equipment or the fire fighting plan.
  - viii) The proper method of fighting fires inside building and tunnels.
  - ix) Special instruction shall be provided for fire brigade leaders in directing and coordinating fire fighting activities.

## 2) Hands-On Training/Practice

Hands-on training/practice sessions shall be held for fire brigade members on the proper method of fighting various types of fires. These sessions shall provide brigade members with practice in extinguishing actual fires, except in the case of energized cables. Practice sessions shall be conducted at facilities remote from the nuclear power plant so as not to endanger safety-related equipment. These practice sessions shall be provided annually.

Practice sessions shall also be conducted that require fire brigade members to don protective equipment, including emergency breathing apparatus. These practice sessions shall not necessarily include fire fighting. These practice sessions shall be provided annually.

3) Drills

Fire brigade drills shall be performed in the plant so that the fire brigade can practice as a team. Drills shall include the following:

- a) The simulated use of equipment for the various situations and types of fires which could reasonably occur in each safety-related area.
- b) Conformance, where possible, to the established plant fire fighting plans (pre-fire plans).
- c) Operating fire fighting equipment where practical. This will include self-contained breathing apparatus, communication equipment and portable and/or installed ventilation equipment.
- d) The drills shall be performed quarterly for each operating shift. The minimum number of fire brigade drills conducted within a calendar quarter shall be equal to the number of operating shifts at the station. Each individual from the Operations organization assigned to the fire brigade shall participate in at least two drills per calendar year. Individuals from the Security organization assigned fire brigade duty at the time of a drill shall participate. Other security personnel shall be provided with a post drill briefing. At least one drill per year for each operating shift shall be unannounced.
- e) Periodically (at least annually), the off-site fire department personnel shall be requested to participate in these drills. These drills shall conform with the facility plan for coordination with off-site fire departments.
- f) The drills shall be preplanned to establish the training objectives of the drills. The drills will be critiqued to determine how well the training objectives have been met. At a minimum, the critique shall assess:
  - i) Fire alarm effectiveness, response time, selection, placement and use of equipment.
  - ii) The leader's direction of the effort and each member's response.

4) Organization

The Shift Supervisor-Operations shall not be a member of the fire brigade.

#### 1.4.3.4 Off-Site Fire Departments

Off-site fire departments shall be offered training annually to include basic radiation principles and practices, typical radiation hazards that may be encountered when fighting fires, and related procedures. This training should also include site access and egress practices and procedures for emergency responders.

## 1.5 CONTENT AND FORMAT

This FPRR is intended to address those fire protection aspects of the plant which are required to satisfy the requirements delineated in Section 1.1. This report focuses primarily on the demonstration of the capability to bring and maintain both units at Susquehanna SES in a safe shutdown condition in the event of a design basis fire.

Section 2.0 of this report provides a listing of terms and definitions to provide clarity and understanding while reviewing this report. Some of the terms are uniquely applicable to the Susquehanna Fire Protection Program while others are defined to provide a uniform base of understanding to the reader.

Section 3.0 of this report explains the methodology used to perform the safe shutdown analysis and to demonstrate that both reactor units can be safely shutdown in the event of a fire.

Section 4.0 of this report describes the active and passive fire protection features used at Susquehanna SES. This includes the fire detection and suppression systems, water supply systems, raceway wrappings, cable insulation, etc.

Section 5.0 of this report contains an item-by-item comparison of Susquehanna SES design with the applicable positions of Appendix A to BTP APSCB 9.5-1 and 10CFR50 Appendix R.

Section 6.0 of this report discusses the fire hazards and plant shutdown methods on a fire area basis. In this section, each fire area of the plant is addressed designating the method to be utilized for achieving and maintaining safe shutdown in the event of a fire.

Section 7.0 of this report contains the Appendix R deviation requests required to support the safe shutdown analysis. Each deviation request addresses plant conditions where a specific Appendix R requirement is not met. The deviation request serves as a means to justify the acceptability of the non-conforming condition based on engineering and fire hazard analysis.

Section 8.0 of this report contains the upper tier fire protection features drawings necessary to understand the technical content of this report and to demonstrate the fire protection features of the plant.

## **2.0 DEFINITIONS**

The definitions presented in this section are used throughout this report.

### **2.1 ADJACENT FIRE ZONE**

An adjacent fire zone is a fire zone which has a physical point of contact with the primary fire zone.

### **2.2 ASSOCIATED CIRCUITS**

Associated Circuits are defined as those cables and components that:

1. Have a physical separation less than that required by Section III.G.2 of Appendix R, and;
2. Have one of the following:
  - a. A common power source with the shutdown equipment (redundant or alternative) and the power source is not electrically protected from the circuit of concern by coordinated breakers, fuses, or similar devices, or
  - b. A connection to circuits of equipment whose spurious operation would adversely affect the shutdown capability (e.g., RHR/RCS isolation valves, ADS valves, instrumentation, steam bypass, etc.), or
  - c. A common enclosure (e.g., raceway, panel, junction) with the shutdown cables (redundant and alternative) and,
    - (1) Are not electrically protected by circuit breakers, fuses or similar devices, or
    - (2) Will allow propagation of the fire into the common enclosure.

### **2.3 BUFFER ZONE**

A buffer zone is a fire zone which acts as a spatial barrier between two adjacent fire areas. Using the fire spread limitations, and by assuring multiple paths within two or more adjacent fire zones (referred to as buffer zones), adequate separation between fire areas with different safe shutdown paths is provided without fire walls (see Deviation Request No. 7).

### **2.4 CATEGORY I COMPONENTS**

A safe shutdown component which may be required to perform a safe shutdown function in the event of potential fire damage in the fire zone where the component is located.

## 2.5 COLD SHUTDOWN

Cold shutdown occurs when the reactor mode switch is in the shutdown position and the average reactor coolant temperature is less than 212°F at saturated conditions. Both the Technical Specification and the FSAR have exercised conservatism by using the value of less than or equal to 200°F for the Cold Shutdown Condition Definition.

## 2.6 FIRE AREA

An area sufficiently bounded to withstand the fire hazards associated with the fire area, and, as necessary, to protect important equipment within the fire area from a fire outside the area. A fire area may consist of one or more fire zones.

## 2.7 FIRE RATED BOUNDARY

A horizontal (floor/ceiling) or vertical (wall) boundary constructed of fire rated components. The lowest fire barrier component rating determines the overall boundary rating. All components comprising the fire barrier are qualified by test or by a fire hazards analysis.

Fire barrier components are:

- a) Wall or floor/ceiling material
- b) Raceway, pipe, penetration seals, etc.
- c) HVAC ducts penetrating the fire barrier
- d) Seismic gap seals
- e) Fire rated doors
- f) Fire rated protection for structural steel

Exception: The primary containment walls are considered to be acceptable as a fire barrier because of their unique construction and since the primary containment is inerted.

## 2.8 FIRE ZONE

A room or compartment separated from all adjacent fire zones by barriers which may or may not be fire rated. Some large open floor areas are divided into a north, a south and a wraparound fire zone with no physical barrier between them. The north and south fire zones depend on the spatial separation of the wraparound zone to act as an equivalent fire barrier.

## 2.9 FLOW DIVERSION COMPONENT

A flow diversion component for Appendix R safe shutdown analysis is a component that can divert fluid flow from any safe shutdown system or the reactor pressure vessel.



## 2.10 IN-SITU COMBUSTIBLES

In-situ combustibles are fixed combustible materials which are permanently installed in the plant.

## 2.11 INTERVENING COMBUSTIBLE

An intervening combustible is a material which can propagate fire from one location to another. This does not include cables in conduit, cables in wrapped cable trays or transient combustibles.

## 2.12 MAJOR SSD COMPONENTS

For purposes of the Fire Protection Review Report, Major SSD components are pumps, valves and instruments and are listed without component numbers. Instruments are identified by system, not by function (i.e. RHR Instrumentation, not RHR Pressure Switch). Major cables are not considered major SSD components.

## 2.13 PRIMARY FIRE ZONE

The primary fire zone is the fire zone where the fire is assumed to be initiated.

## 2.14 SAFE SHUTDOWN

For Appendix R, Section III.G, Safe Shutdown is defined as the ability to achieve and maintain hot shutdown conditions with those systems required for cold shutdown able to be repaired within 72 hours.

For Appendix R, Section III.L, Safe Shutdown is defined as the ability to achieve cold shutdown conditions within 72 hours and to maintain cold shutdown conditions thereafter.

## 2.15 SAFE SHUTDOWN COMPONENT

A component which is part of a safe shutdown system listed in Table 3.3-1 which may be required to perform its safe shutdown function in the event of the fire scenarios described in 10CFR50 Appendix R.

## 2.16 SAFE SHUTDOWN PATHS

Paths that have been analyzed in accordance with Appendix R, to accomplish safe shutdown.

The following paths are available to accomplish safe shutdown:

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### Path 1. Division I with Automatic Depressurization System and Core Spray System.

This path uses ADS to depressurize the vessel and Core Spray to provide reactor coolant make up. Other systems and components used to support shutdown and long term cooling are:

- Control Rod Drive System (SCRAM Function)
- Main Steamline Isolation Valve
- Nuclear Boiler Instrumentation (Portions)
- Residual Heat Removal System (Suppression Pool Cooling Mode)
- Suppression Pool Monitoring Instrumentation
- Residual Heat Removal Service Water System
- RHR Room Cooler
- RCIC Room Cooler (Non-fire Unit)
- Emergency Service Water System and
- ESSW Pumphouse HVAC
- Diesel Generator "A" and "C" and Support Systems

### Path 2. Remote Shutdown Panels

This path uses the A, B, C Safety Relief Valves or individual ADS SRV's for pressure control and RCIC and Residual Heat Removal System for coolant make up, shutdown cooling and suppression pool cooling. Other systems and components used to support shutdown and long term cooling are:

- Control Rod Drive System (SCRAM Function)
- Main Steamline Isolation Valves
- Suppression Pool Monitoring Instrumentation
- Remote Shutdown Panel Indication
- Residual Heat Removal Service Water System
- RHR Room Cooler
- Emergency Service Water System and
- ESSW Pumphouse HVAC
- All Diesel Generators and Support Systems
- Nuclear Boiler Instrumentation (Portions)

### Path 3. Division II with Automatic Depressurization System and Core Spray System

This path is the same as Path 1 except the opposite division's equipment is used. And the HPCI Room Cooler for the non-fire unit is required in lieu of the RCIC Room Cooler.

## 2.17 TRANSIENT COMBUSTIBLES

Transient combustibles are combustible materials which are not permanently located in the plant and are administratively controlled.

## 2.18 WRAPAROUND AREA

On Elevations 683'-0", 719'-1", and 749'-1" of both reactor buildings, an area 66 feet wide has been designated as the Wraparound Area. The Wraparound Area is a physical area used to provide spatial separation between the north and south sides of the reactor buildings, each of which generally contains opposite paths of safe shutdown equipment. Within the Wraparound Area, both paths of safe shutdown equipment are protected, unless specifically identified in a deviation request. The concept of the Wraparound Area is presented in Deviation Request No. 4.

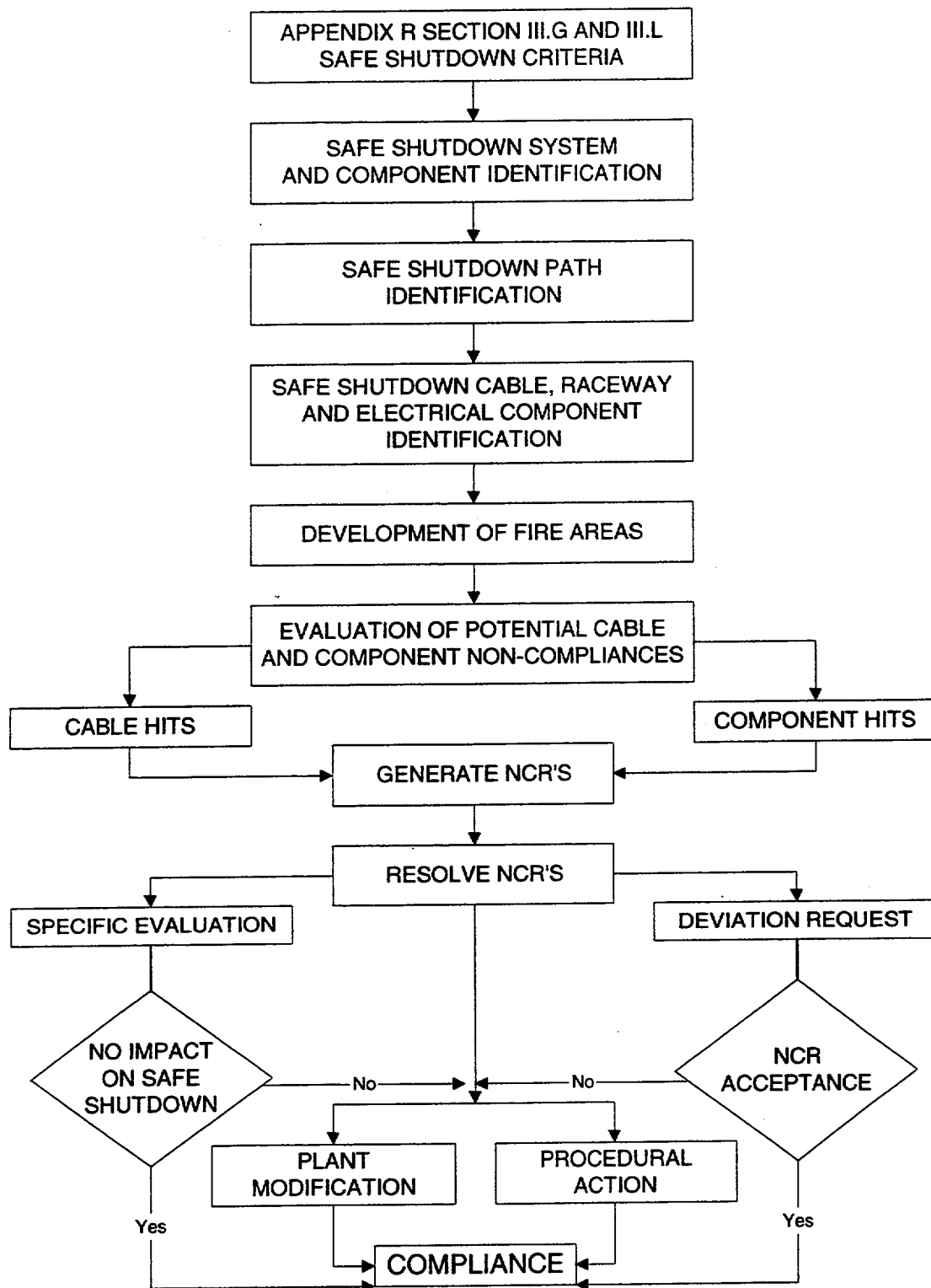
### **3.0 SAFE SHUTDOWN ANALYSIS**

#### **3.1 INTRODUCTION**

The purpose of this section is to identify the methodology utilized by PPL to demonstrate that both units can be brought to and maintained in a safe shutdown condition assuming a fire in any fire area as required by 10CFR50 Appendix R Sections III.G, III.J, III.L (as required by III.G.3) and III.O.

Table 3.1-1 is a flow chart which outlines the methods used to bring PPL into compliance with Appendix R Sections III.G and III.L.

SSES-FPRR  
TABLE 3.1-1  
APPENDIX R COMPLIANCE FLOW CHART



## 3.2 CRITERIA

### 3.2.1 Appendix R Section III.G

The criteria used to demonstrate shutdown capability in accordance with Appendix R Section III.G are as follows:

The shutdown capability from either the control room or Remote Shutdown Panel shall be able to (a) achieve and maintain subcritical reactivity conditions in the reactor; (b) maintain reactor coolant inventory; (c) achieve and maintain hot shutdown; (d) repair systems necessary to achieve and maintain cold shutdown within 72 hours.

During the postfire shutdown, the reactor coolant system process variables shall be maintained within those predicted for a loss of normal a.c. power, and the fission product boundary integrity shall not be affected; i.e. there shall be no fuel clad damage, rupture of any primary coolant boundary, or rupture of the containment boundary. The reactor coolant makeup function maintains the reactor water level above the top of active fuel as detailed in Deviation Request No. 33.

Shutdown systems installed to ensure postfire shutdown capability need not be designed to meet seismic Category I criteria, single failure criteria, or other design basis accident criteria, except where required for other reasons, e.g., because of interface with or impact on existing safety systems, or because of adverse valve actions due to fire damage.

The safe shutdown equipment and systems for each fire area shall be known to be isolated from associated non-safety circuits in the fire area so that hot shorts, open circuits or shorts to ground in the associated circuits will not prevent operation of the safe shutdown equipment. The separation and barriers between trays and conduits containing associated circuits of one safe shutdown division and trays and conduits containing circuits or safe shutdown cables from the redundant division, or the isolation of these associated circuits from the redundant division, or the isolation of these associated circuits from the safe shutdown equipment, shall be such that a postulated fire involving associated circuits will not prevent safe shutdown.

No design basis event or non-fire damage induced equipment failure is considered in conjunction with a fire for this section.

### 3.2.2 Appendix R Section III.L

Appendix R Section III.L criteria has been used to demonstrate alternate or dedicated shutdown capability.

The systems and equipment needed for post fire safe shutdown are those systems necessary to perform the following shutdown functions: reactivity control, reactor coolant makeup, reactor depressurization and heat removal, process monitoring and

associated support functions. The criteria as stated in Appendix R Section III.L for systems performing other shutdown functions are as follows:

Alternative and dedicated shutdown capability provided for a specific fire area shall be able to (a) achieve and maintain subcritical reactivity conditions in the reactor; (b) maintain reactor coolant inventory; (c) achieve and maintain hot shutdown; (d) achieve cold shutdown conditions within 72 hours; and (e) maintain cold shutdown conditions thereafter. During the postfire shutdown, the reactor coolant system process variables shall be maintained within those predicted for a loss of normal a.c. power, and the fission product boundary integrity shall not be affected; i.e. there shall be no fuel clad damage, rupture of any primary coolant boundary, or rupture of the containment boundary.

The shutdown capability for specific fire areas may be unique for each such area, or it may be one unique combination of systems for all such areas. In either case, the alternative shutdown capability shall be independent of the specific fire area(s) and shall accommodate postfire conditions where off-site power is available and where off-site power is not available for 72 hours. Procedures shall be in effect to implement this capability.

If the capability to achieve and maintain cold shutdown will not be available because of fire damage, the equipment and systems comprising the means to achieve and maintain the hot standby or hot shutdown condition shall be capable of maintaining such conditions until cold shutdown can be achieved. If such equipment and systems will not be capable of being powered by both onsite and off-site electric power systems because of fire damage, an independent onsite power system shall be provided. The number of operating shift personnel, exclusive of fire brigade members, required to operate such equipment and systems shall be on site at all times.

Equipment and systems comprising the means to achieve and maintain cold shutdown conditions shall not be damaged by fire; or the fire damage to such equipment and systems shall be limited so that the systems can be made operable within 72 hours. When the alternate shutdown path is used cold shutdown will be achieved within 72 hours. Materials for such repairs shall be readily available on site and procedures shall be in effect to implement such repairs. If such equipment and systems used prior to 72 hours after the fire will not be capable of being powered by both onsite and off-site electric power systems because of fire damage, an independent onsite power system shall be provided. Equipment and systems used after 72 hours may be powered by off-site power.

Shutdown systems installed to ensure postfire shutdown capability need not be designed to meet seismic Category I criteria, single failure criteria, or other design basis accident criteria, except where required for other reasons,

e.g., because of interface with or impact on existing safety systems, or because of adverse valve actions due to fire damage.

The safe shutdown equipment and systems for each fire area shall be known to be isolated from associated non-safety circuits in the fire area so that hot shorts, open circuits or shorts to ground in the associated circuits will not prevent operation of the safe shutdown equipment. The separation and barriers between trays and conduits containing associated circuits of one safe shutdown division and trays and conduits containing circuits or safe shutdown cables from the redundant division, or the isolation of these associated circuits from the safe shutdown equipment, shall be such that a postulated fire involving associated circuits will not prevent safe shutdown.

Other than a loss of off-site power, no design basis event or non-fire damage induced equipment failure is considered in conjunction with a fire for this section.

#### 3.2.3 Appendix R Section III.J

Appendix R Section III.J requires that emergency lighting with at least an 8 hour battery power supply be provided in all areas needed for operation of safe shutdown equipment and in access and egress routes thereto.

#### 3.2.4 Appendix R Section III.O

Appendix R Section III.O requires that the reactor coolant pump be equipped with an oil collection system if the containment is not inerted during normal operation.



### 3.3 METHODOLOGY

The safe shutdown analysis performed by PP&L is an engineered methodology which demonstrates and assures the operability of those systems, components, and raceway required to function as the result of an Appendix R fire in any fire area of the plant.

#### 3.3.1 Appendix R Sections III.G and III.L

##### 3.3.1.1 Safe Shutdown System and Component Identification

As discussed in Section 3.2, the following functions were considered in choosing the systems and components required for safe shutdown: reactivity control, reactor coolant makeup, reactor depressurization and heat removal, process monitoring, and associated support functions.

The first step in performing the safe shutdown analysis was to identify the systems that could be used to perform the safe shutdown functions. Various safe shutdown paths were originally evaluated to shutdown the dual unit plant for the conditions described in Section 3.2.

In order to separate redundant divisions of safe shutdown equipment, two primary safe shutdown paths were selected. These paths are the Division I train of ADS/Core Spray, Alternate Shutdown Cooling and Suppression Pool Cooling and the Division II train of ADS/Core Spray, Alternate Shutdown Cooling and Suppression Pool Cooling. These paths became identified as Paths 1 and 3, respectively. These paths are incorporated into our symptom based emergency operating procedures and off normal procedures and are discussed in FSAR Subsections 15.2.9, 15.6.4.2.1.1 and 15A.6.5.3. These two paths offer good electric divisional separation between paths so as to limit the number of potential noncompliant cables and to reduce the number of associated circuit concerns.

The capability to simultaneously achieve safe shutdown of both units has been assured by protecting safe shutdown Path 1 or 3 for both units and, in addition, protecting HPCI and associated support systems or RCIC and associated support systems on the unit not experiencing the fire.

Path 2, or the Alternative Shutdown Path, is based on evacuation from the Main Control Room, and shutting down the plant from the respective Remote Shutdown Panel of each unit and locally as required.

Reactivity control on all paths is performed by portions of the Reactor Protection System and the Control Rod Drive System (SCRAM function). The Appendix R Safe Shutdown Analysis assures either a manual scram from the Control Room or, where necessary, a scram by venting the instrument air header locally. The Alternative Shutdown Path utilizes a manual SCRAM from the Main Control Room prior to evacuation of the Control Room.

Reactor coolant makeup is provided by different divisions of the Core Spray System for Paths 1 and 3 and by RCIC and RHR injection on the Alternative Shutdown Path (Path 2).

MSIV closure is relied upon for all shutdown paths. This simplifies the analysis by making shutdown paths the same whether or not off-site power is available. If the MSIV's do not isolate automatically, they are isolated manually.

Reactor depressurization is provided by ADS SRVs on Paths 1 and 3, as described in Deviation Request No. 33. On Path 2, reactor depressurization can be performed by opening one of three specific SRVs from the remote shutdown panel or ADS SRVs locally.

For Paths 1 and 3, the reactor heat removal process utilizes alternate shutdown cooling with suppression pool cooling. Normal shutdown cooling and suppression pool cooling is used on the Alternative Shutdown Path. It should be recognized that one loop of Suppression Pool Cooling is required for all paths.

Alternate shutdown cooling utilizes the Core Spray System and ADS SRVs. It is used if reactor pressure vessel (RPV) cooldown is required but cannot be accomplished using normal shutdown cooling. To enter alternate shutdown cooling, the reactor head vents, the MSIVs, main steam line drain lines, and the RHR steam condensing mode lines must all be closed. Then, the SRVs are opened and one core spray pump taking suction from the suppression pool slowly increases reactor water level. The suppression pool cooling mode of RHR is initiated. Reactor water level is slowly raised to flood the main steam lines and establish a flow path through the open SRVs and back to the suppression pool.

Process monitoring is provided for all paths. The selection of instrumentation to monitor process variables is based on NRC Information Notice 84-809 dated March 7, 1984, Attachment 1, Section IX and addresses the following considerations: 1) The operators must be able to monitor RPV level and pressure because these are the two parameters that alert the operators to manually SCRAM the reactor and/or actuate a safe shutdown system, 2) Flow rate indication is required for makeup systems and 3) Since the suppression pool rather than the condenser is being used as the heat sink, both suppression pool temperature and level are monitored. In the event of a fire in the vicinity of Instrument Racks 1C004 and 1C005 on Elevation 749'-1 in Unit 1 and 2C004 and 2C005 on Elevation 749'-1 on Unit 2, Deviation Request No. 27 and 28, respectively, have justified the ability to achieve and maintain safe shutdown in the event of a loss of RPV level and pressure indication.

The support functions either remove heat or supply power to the process system functions of reactivity control, reactor coolant makeup, reactor depressurization, and heat removal.

The support system for reactor heat removal is RHR Service Water which removes heat from the suppression pool in the suppression pool cooling mode and from the reactor loop through the heat exchanger in shutdown cooling. Cooling for equipment is provided by the emergency service water system through the RHR room coolers and HPCI and RCIC room coolers for the non-fire unit. No other RB HVAC components are necessary to achieve safe shutdown.

Control Structure HVAC is not necessary to achieve and maintain cold shutdown if the following Operator actions are taken:

- Selected electrical heat loads located in the Control Structure must be de-energized within 24 hours following a complete loss of Control Structure HVAC.
- Selected electrical cabinet doors located in the Control Structure must be opened to reduce the internal cabinet temperature within 24 hours following a complete loss of Control Structure HVAC.
- The 125 and 250 VDC Battery Chargers must be verified to be in float mode and the doors to the 250 VDC Battery Rooms must be opened within 6 hours following a loss of the Battery Room Ventilation System.

Power is supplied by the diesel generators and the batteries to the various components with the AC and DC distribution system modifying voltages as appropriate and distributing the power.

The Nuclear Boiler Instrumentation has been evaluated to assure that a spurious actuation of a safety system will not adversely affect the ability to achieve and maintain safe shutdown. Automatic initiation of safety systems is not credited in the Appendix R Safe Shutdown Analysis. Although automatic safety system actuations may occur, the Appendix R Safe Shutdown Analysis assures the availability of manual system initiation only.

The effects of fire induced spurious signals were reviewed to assure that these will not result in an overfilling or an inventory loss from the reactor pressure vessel or a flow diversion or flow blockage in the safe shutdown systems being used for inventory make up or decay heat removal. It was determined that there were no adverse effects introduced by this scenario and that safe shutdown can be achieved using protected safe shutdown components.

Flow diversion has the potential to prevent safe shutdown by diverting flow from a safe shutdown system or causing a loss of coolant from the RPV. The RPV and all safe shutdown systems were reviewed for potential flow diversion paths. High/Low pressure interfaces were analyzed and spurious openings of the SRVs were considered.

Flow diversion paths were determined by reviewing all penetrations of the reactor pressure vessel and all safe shutdown system flow paths and identifying all lines too small to allow a significant flow diversion. All lines that would permit a significant flow diversion were then traced to a point where a determination of flow diversion could be made. This point was always a check valve, a normally closed manual valve, or an actuated valve. It was assumed that check valves function properly and prevent flow diversion and that normally closed manual valves would be in the correct position to prevent flow diversion. Actuated valves were evaluated and dispositioned by one of the methods discussed in Subsections 3.3.1.3 and 3.3.1.5.

For use of each unit's remote shutdown panel (Alternative Shutdown Path) the following assumptions were made:

1. The reactor is scrammed in the control room prior to control room evacuation.
2. Offsite power is lost as well as automatic starting of the onsite diesel generators and the automatic function of valves and pumps whose control circuits could be affected by a control room fire.
3. Spurious signal(s) as required by NRC Generic Letter 86-10.

The analysis demonstrates that capability exists to manually achieve safe shutdown conditions from outside the control room by restoring a.c. power to designated pumps, assuring that valve lineups are correct, and assuring that any spurious valve operations which could permit the loss of reactor coolant can be corrected before unrestorable conditions occur. A communication system has been provided where necessary to facilitate these manual actions. This communication system is described in Section 4.13.

### 3.3.1.2 Safe Shutdown Path Identification

After identifying the systems required to support the safe shutdown function, the systems were grouped into various shutdown paths. Three safe shutdown paths were developed. They are as follows:

- Path 1 - The safe shutdown path comprised primarily of Division 1 equipment and cables. This path is used to achieve and maintain safe shutdown in those fire areas where the majority of the installed equipment and cables are Division II.
- Path 2 - The alternative shutdown path or remote shutdown panel which is used for achieving and maintaining safe shutdown in Fire Area CS-9, which is comprised of the Main Control Room fire zones.
- Path 3 - The safe shutdown path composed primarily of Division II equipment and cables. This path is used to achieve and maintain safe shutdown in those

fire areas where the majority of the installed equipment and cables are Division I.

See Table 3.3-1 for a listing of the safe shutdown systems in each safe shutdown path.

#### 3.3.1.3 Safe Shutdown Cable, Raceway and Electrical Components Identification

Having identified all the systems and process components required to achieve safe shutdown, the cables required to operate this equipment were identified. The schematics or elementary wiring diagram for each electrically dependent component was reviewed. For each component, all circuit cables that ensure operability of the component were initially identified as required for safe shutdown. The circuits identified included those for power, control and instrumentation. Additionally, all interlocks in the safe shutdown components circuit were traced back to the initiating devices and all corresponding cables were identified as potentially impacting the safe shutdown component of concern. In this way, all system interactions were identified. The safe shutdown component and cable information was entered into a computer database that contained cable/raceway by plant location. In order to identify preferred safe shutdown paths by plant location, the plant was divided into fire areas.

#### 3.3.1.4 Development of Fire Areas

Our safe shutdown analysis is based on a fire area concept. Each fire area at the plant uses one of the three safe shutdown paths described in Subsection 3.3.1.2 to achieve and maintain safe shutdown. The safe shutdown path used for each fire area is presented in Table 6.1-1.

To perform the safe shutdown analysis, the plant was initially analyzed on a fire zone basis. A fire zone is a room or compartment usually separated from adjacent fire zones by a physical barrier. These barriers typically consist of reinforced concrete walls, ceilings and floors or gypsum board walls. These barriers may or may not be fire rated. Penetrations and openings in these non-rated barriers are usually treated in a similar manner as those for fire rated barriers. Therefore, fire zone boundaries should generally resist the spread of fire by a radiant heat transfer mechanism. Deviation Request No. 7 further outlines the fire spread limitation criteria. Each fire zone utilizes one of the three safe shutdown paths identified in Section 3.3.2 for achieving and maintaining safe shutdown.

For Appendix R compliance, it was necessary to group these fire zones into fire areas. A fire area is comprised of one or more fire zones and is bounded on all sides by fire rated construction or spatial separation. The fire rated boundaries of these fire areas are designed to ensure that a fire initiated anywhere within the fire area does not propagate into or adversely impact any other fire area in the plant.

Since the wraparound fire zones and the buffer fire zones would eventually comply with the requirements of both adjoining fire areas, they were considered to be in both fire

areas. The plant specific fire hazards analysis in Section 6.0 discusses fire area separation in more detail.

The physical boundaries of all the fire areas were evaluated and upgraded as necessary to ensure that they are fire rated barriers. All penetrations and openings in these barriers are equipped with fire rated assemblies or are justified by deviation requests. The integrity of the fire barriers are assured by ongoing plant surveillance activities.

The plant specific fire hazards analysis in Section 6.0 is presented on a fire area basis, however, within the discussion of each fire area, safe shutdown components are described on a fire zone basis to more specifically identify the location for this equipment.

#### 3.3.1.5 Evaluation of Potential Cable and Component Noncompliances

The Appendix R data was sorted by fire zone to develop a list of all potential Appendix R noncompliances which were termed cable hits. Each cable hit was evaluated either individually or on a generic basis, to determine the impact of fire induced faults on all affected components. By the term "cable hit" it is meant that the individual cable required for the proper function of a safe shutdown component is improperly located for the Appendix R analysis. For example, if a fire zone contains predominantly Division I (Path 1) components, Division II (Path 3) components would be used to achieve safe shutdown in the event of a fire in that fire zone. The reason for this is that the Division I components located in the zone of fire origin would be assumed inoperable. The Division II components would be located in a different fire area, and would consequently remain free of fire damage. Therefore, Division II (Path 3) would be used to achieve safe shutdown. However, if a cable to one of the Division II safe shutdown components was routed through the Division I zone, that cable could potentially be destroyed by the fire in that zone. This cable would be called a "cable hit". It should be noted that not all cable hits are noncompliances as discussed in Section 3.3.1.6.

The evaluation process consisted of examining each fire zone to determine the number of cable hits generated by first assuming that Division I (Path 1) was required for safe shutdown in that fire zone and then assuming that Division II (Path 3) was required for safe shutdown in that fire zone. The path with the least number of cable hits was then designated as the required safe shutdown path for that fire zone.

Safe shutdown components were evaluated in a similar manner as cable hits. Components in noncompliance with Appendix R (i.e., component hits) were called Category I Components.

The evaluation process also considered a number of electrical components. Each component was evaluated to determine its affect on safe shutdown. The types of components evaluated and a brief description of their analysis follows:

### Pseudo-Components

The concept of pseudo-components was developed to account for certain safe shutdown cables which constitute a control circuit scheme common to various components within a system. A pseudo-component is merely a designation given to a group of cables/devices whose sole purpose is to actuate various safe shutdown components based on certain plant parameters. The purpose for the pseudo-components is to distinguish the cabling and other electrical components for the common circuit scheme from the primary control circuit of each component. In addition, by associating the cables of a common scheme with a pseudo-component, it avoids the duplication of the common scheme cables and components under each of the affected safe shutdown components.

### Interlocks

In order to assure that all system interactions were accounted for, the control circuits for each safe shutdown component was reviewed to identify all interlocks whose failure could adversely affect the required component function. Each interlock component and its respective cables were then evaluated to assess the effect of fire induced failures on the Safe Shutdown component. Interlocks and their connected cables which could adversely affect Safe Shutdown components were identified as being required for safe shutdown. Therefore, interlock components were analyzed in the same manner as Safe Shutdown components.

### Electrical Distribution Components

These are power supplies or other electrical equipment that supports components required for safe shutdown. The required safe shutdown paths for these components was assigned based on the required paths for each safe shutdown load fed by a particular power supply. Included on this list are switchgear, load centers, motor control centers, load center transformers, distribution panels, DC control centers, DC battery chargers, DC batteries, fuse boxes, and battery banks.

### Postulated Cable Faults

Each cable hit was subjected to an evaluation which postulated a hot short, short-to-ground and an open circuit on the cable. Within the context of this report the following definitions are utilized to describe cable faults.

- Hot Short - An applied voltage between conductors of the same cable or of a different cable of the same voltage as a result of a fire induced short circuit.
- Open Circuit - A fire induced break in a conductor resulting in a loss of circuit continuity.

- Short to Ground - A fire induced breakdown of a cable's insulation system resulting in the potential on the conductor being applied to ground potential.

The methodology used to postulate cable faults and their duration was based on the guidance provided in NRC Generic Letter 86-10 Section 5.3.

#### High/Low Pressure Interfaces

For the purposes of postulating credible fire-induced cable faults for high/low pressure interfaces, the criteria outlined in Section 5.3.1 of NRC Generic Letter 86-10 was utilized as it pertains to three-phase AC power cables. That is, a hot short on all three phases in the proper sequence causing spurious actuation of a high/low pressure interface valve is assumed credible.

For the purpose of establishing a criteria for the postulation of faults on control cables, multiple (i.e., two) selective hot shorts without grounding resulting in the spurious opening of a valve is assumed credible (although highly unlikely) for high/low interfaces. This conservative assumption is utilized based on the NRC's conservative viewpoint regarding high/low pressure interfaces.

Spurious actuation of the safety relief valves was investigated. Based on the conservative methodology utilized in postulating cable fault credibility for high/low interfaces, it was determined that spurious operation of multiple SRV's was credible.

#### Associated Circuits

Several studies were completed to identify and demonstrate compliance with NRC Generic Letter 81-12 which provides a definition of associated circuits for Appendix R consideration and provides guidelines for protecting the safe shutdown capability from the fire-induced failures of associated circuits.

The electrical buses required for safe shutdown were identified and all circuits from those buses were analyzed for their safe shutdown function. All of the associated circuits (circuits not required for safe shutdown) were identified and potential associated circuits of concern were identified by comparison of the bus safe shutdown paths with the fire zone safe shutdown paths for those areas through which associated circuit cables were routed. An associated circuit became an associated circuit of concern when the associated circuit cable entered a fire zone where the required safe shutdown path was the same as the safe shutdown path assigned to the bus.

It was verified by calculation or analysis that the potential associated circuit of concern would not impair the safe shutdown function of any other circuit powered from the same bus.

Cables which were connected to safe shutdown components were analyzed and were classified as safe shutdown circuits even though they were not required to be functional



but their loss could result in the misoperation of the identified safe shutdown component.

#### Multiple High Impedance Faults (MHIF)

The possibility of multiple faults exist when circuits on the same bus are routed in the same raceway. The nature of multiple high impedance faults is that the fault current of the individual branch circuits could be below the trip setting of the branch breakers. If enough branch circuits on the same bus failed in this manner, the additive currents could trip the upstream main breaker for the bus. This could then disable safe shutdown circuits on this bus.

MHIFs were addressed by analyzing all of the safe shutdown power buses at the following voltages: 4160, 480, 120 AC and 250, 125 DC. All associated circuits of concern on a common bus were identified within a common "hit" fire zone. Unprotected safe shutdown circuits of the common bus in the hit fire zone were also identified and the fault currents were added to the associated circuit fault current.

The total MHIF current was calculated using Generic Letter 86-10 criteria and was added to the total running current of the bus. For all safe shutdown buses, this current did not exceed the long time trip setting of the bus main breaker. Therefore, no multiple high impedance fault concerns exist for safe shutdown buses at Susquehanna Steam Electric Station Units 1 and 2.

#### Spurious Actuation

The guidance provided in NRC Generic Letter 86-10 was utilized in the evaluation of each cable hit which could cause spurious actuation of a component. For those spurious actuations which were the result of a hot short, no limitation was placed on the hot short duration. The hot short condition was postulated to exist until action was taken to isolate the fault and negate the spurious operation.

In addition to these electrical components, other equipment which could affect the safe shutdown analysis was also evaluated. This equipment included:

#### Instrument Tubing

The evaluation on instrument tubing was performed in a manner similar to that used to determine and evaluate Category I cables. Each instrument on the required component list was reviewed to determine those with associated tubing. The process tap, tubing, and instrument location (fire zones) were identified for each instrument with tubing. The tubing was identified as Category I if any of the tubing was routed through a fire zone on the same shutdown path as the instrument under evaluation. Each Category I hit was evaluated to assess the potential impact on instrument operation and subsequent system/component function.

### HVAC Fire Dampers

An evaluation was performed to determine which HVAC systems are required to achieve and maintain safe shutdown. The postulated closure of HVAC fire dampers does not have an adverse affect on safe shutdown.

#### 3.3.1.6 Resolution of Cable and Component Noncompliances

All noncompliant cables and components were reviewed to determine their proper disposition. Many of the cable hits were grouped by unique function and addressed under specific analyses. Individual raceways with numerous cable hits were identified for fire protective wrapping to preclude a specific analysis for each cable hit contained within the raceway. Some cable hits were located in raceway which was already wrapped or planned to be wrapped for other cable hit dispositions. All remaining cable hits were grouped by system and component and an evaluation was performed to determine the impact of a fire-induced cable failure on the component and on the safe shutdown analysis.

Based on the above evaluations, each cable hit was ultimately resolved by performing a plant modification (i.e., fire wrapping, circuit modification, cable relocation), a procedural/manual action, further analysis which verified that fire-induced faults would not adversely impact safe shutdown or by a deviation request.

Category I components were grouped by function and evaluated in a specific analysis. These analyses took into consideration component location within the fire zone, combustible loading, arrangement and location of fire detection and suppression within the zone. Also considered was separation between components of the redundant shutdown division. Category I components were resolved by a plant modification, a procedural action, a deviation request or an analysis which verified that fire damage to the component would not adversely affect safe shutdown.

#### 3.3.2 Appendix R Section III.J

Emergency lighting with an 8 hour battery power supply is provided in the main control room and along the access and egress routes from the main control room to each unit's respective remote shutdown panel, to local areas required for operation required for manual control of safe shutdown equipment.

#### 3.3.3 Appendix R Section III.O

Susquehanna SES Unit 1 and Unit 2 primary containments are inerted during normal operations, compliance with Section III.O is achieved.

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<b>TABLE 3.3-1</b> <b>APPENDIX R SAFE SHUTDOWN ANALYSIS</b> <b>SAFE SHUTDOWN PATHS</b>		
<b>DIVISION I*</b> <b>PATH 1</b>	<b>REMOTE SHUTDOWN PANELS</b> <b>PATH 2</b>	<b>DIVISION II*</b> <b>PATH 3</b>
<u>REACTIVITY CONTROL</u>  CRD (Scram Function) RPS (Portions)	<u>REACTIVITY CONTROL</u>  CRD (Scram Function) Manual SCRAM (RPS)	<u>REACTIVITY CONTROL</u>  CRD (Scram Function) RPS (Portions)
<u>REACTOR COOLANT MAKEUP</u>  Inboard MSIVs Core Spray Nuc. Boiler Instru. (Portions)	<u>REACTOR COOLANT MAKEUP</u>  Inboard MSIVs RCIC Nuc. Boiler Instru. (Mechanical Portions)	<u>REACTOR COOLANT MAKEUP</u>  Outboard MSIVs Core Spray Nuc. Boiler Instru. (Portions)
<u>REACTOR HEAT REMOVAL PROCESS</u>  Manual ADS/SRVs RHR Supp. Pool Cooling Mode	<u>REACTOR HEAT REMOVAL PROCESS</u>  Manual/ADS/SRVs RHR Injection, RHR Supp. Pool Cooling, and Shutdown Cooling Modes	<u>REACTOR HEAT REMOVAL PROCESS</u>  Manual ADS/SRVs RHR Supp. Pool Cooling Mode
<u>MONITORING</u>  Supp. Pool Monitoring	<u>MONITORING</u>  Supp. Pool Monitoring Remote Shutdown Panel Indication	<u>MONITORING</u>  Supp. Pool Monitoring
<u>ASSOCIATED SUPPORT FUNCTIONS</u>  RHRSW R.B. HVAC a) RHR Room Coolers b) RCIC Room Coolers (non-fire unit)	<u>ASSOCIATED SUPPORT FUNCTIONS</u>  RHRSW R.B. HVAC a) RHR Room Coolers	<u>ASSOCIATED SUPPORT FUNCTIONS</u>  RHRSW R.B. HVAC a) RHR Room Coolers b) HPCI Room Coolers (non-fire unit)
<u>COMMON REQUIRED COMPONENTS</u>  ESW ESSW Pumphouse HVAC D.G. Aux. Systems	<u>COMMON REQUIRED COMPONENTS</u>  ESW ESSW Pumphouse HVAC D.G. Aux. Systems	<u>COMMON REQUIRED COMPONENTS</u>  ESW ESSW Pumphouse HVAC D.G. Aux. Systems
<u>ELECTRICAL</u>  EDGs A&C Respective Distribution Equipment	<u>ELECTRICAL</u>  EDGs A, B, C & D Respective Distribution Equipment	<u>ELECTRICAL</u>  EDGs B & D Respective Distribution

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<b>TABLE 3.3-1</b> <b>APPENDIX R SAFE SHUTDOWN ANALYSIS</b> <b>SAFE SHUTDOWN PATHS</b>		
<b>DIVISION I*</b> <b>PATH 1</b>	<b>REMOTE SHUTDOWN PANELS</b> <b>PATH 2</b>	<b>DIVISION II*</b> <b>PATH 3</b>
<b>APPENDIX R VOICE POWERED</b> <b>COMMUNICATION SYSTEM (UNIT 1)</b>  Communication Loop No. (1-1) Communication Loop No. (1-5)	<b>APPENDIX R VOICE POWERED</b> <b>COMMUNICATION SYSTEM (UNIT 1)</b>  Communication Loop No. (1-2)	<b>APPENDIX R VOICE POWERED</b> <b>COMMUNICATION SYSTEM (UNIT 1)</b>  Communication Loop No. (1-3) Communication Loop No. (1-4) Communication Loop No. (1-5)
<b>APPENDIX R VOICE POWERED</b> <b>COMMUNICATION SYSTEM (UNIT 2)</b>  Communication Loop No. (2-1) Communication Loop No. (2-4) Communication Loop No. (1-5)	<b>APPENDIX R VOICE POWERED</b> <b>COMMUNICATION SYSTEM (UNIT 2)</b>  Communication Loop No. (2-2)	<b>APPENDIX R VOICE POWERED</b> <b>COMMUNICATION SYSTEM (UNIT 2)</b>  Communication Loop No. (2-3) Communication Loop No. (1-5)
* These paths are not completely divisionalized.		

### 3.4 LONG TERM COMPLIANCE

Long term compliance to Appendix R is essential to the safe operation of Susquehanna SES. Our Appendix R long term compliance program is implemented through a series of design standards, specifications, drawings and administrative procedures. Plant modifications are reviewed in the design process for their impact on the safe shutdown analysis, deviation requests, combustible loading analysis and other fire hazard configurations. Existing fire protection features are inspected through ongoing surveillances required by Technical Requirements Manual.

#### **4.0 FIRE PROTECTION SYSTEM DESCRIPTION**

This section provides an integrated description of the fire suppression and detection systems which can be used in conjunction with specific discussions in Section 6.0.

Components for the fire suppression and detection systems contained within safety related areas, which would cause damage to the safety related equipment should they fail, are supported so that structural integrity will be maintained through a safe shutdown earthquake.

National Fire Protection Association (NFPA) codes and standards were used as guidance for the Susquehanna Fire Protection Program. The date of the NFPA code or standard used corresponds with the date in effect when the original design document or procedure was approved. It is not PPL's nor NFPA's intent that code changes be retroactively applied to existing conditions.

#### 4.1 FIRE PROTECTION WATER SUPPLY SYSTEMS

The fire protection water supply systems are shown schematically on Drawing E-106227. The plant's two automatic fire pumps have three suction sources: the two cooling tower basins each containing six million gallons of water and the 500,000 gallon clarified water storage tank from which a minimum of 300,000 gallons of water are available. The clarified water storage tank is provided with an internal standpipe that terminates at the 300,000 gallon level thereby limiting use of the tank's contents for other than fire protection purposes to 200,000 gallons.

The 300,000 gallons of water in the clarified water storage tank and the contents of one of the cooling tower basins are available for fire protection use. The other cooling tower basin is provided with a normally closed valve on the fire pump suction supply.

The fire protection water supply system has two horizontal centrifugal type fire pumps, each rated for 2500 gpm at 125 psig (net head). Both pumps are located in the circulating water pump house. One pump is motor driven and one is diesel engine driven with a day tank containing enough diesel fuel oil for 8 hours of operation in accordance with NFPA 20.

A jockey pump maintains a system pressure of 105 to 125 psig to prevent frequent operation of the main fire pumps. Should the fire main pressure fall the motor driven pump and diesel driven pump start sequentially to maintain system pressure at greater than or equal to 85 psig. Both pumps continue running until shut off manually.

The largest single demand can be satisfied by one fire pump. With a loss of both offsite power supplies, the electric fire pump cannot operate. The diesel fire pump can be started either from the diesel pump controller or in the control room using the diesel fire pump batteries as a power source; no a.c. power is required for the diesel pump starting.

The sectional and control valves of both fire pumps and the manual valve in the fuel supply line for the diesel fire pump are locked open and administratively controlled.

Either one or both pumps can be started manually from the fire protection control panel in the main control room or locally at the circulating water pump house, in which both pumps are located.

The electric power for the electric motor driven fire pump is taken from a load center that is supplied by two power sources.

If the primary power source fails, the power will automatically be transferred to the secondary power source.

Alarms including "pump running", "power failure", and "failure to start" are provided and arranged to annunciate in the control room and at the local fire pump panels for

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monitoring the pumps. For test purposes, a flowmeter has been installed on a test manifold in the pump discharge piping, which indicates flow locally.

A 12-in. diameter cement-lined, ductile-iron yard loop encircling the plant is buried in the ground below the frost level, and is made of piping which conforms to the requirements of NFPA 24. A secondary loop surrounds the site support buildings. For the yard main arrangement refer to Drawing E-105176. Post indicator valves have been provided for sectional control. Fire fighting equipment is provided for fire hydrants using the guidelines of NFPA 24.

The diesel driven fire pump is enclosed within a 3 hour fire rated enclosure which prevents both fire pumps from being damaged by a single fire.

In addition to the above, the Susquehanna SES site has a backup fire protection system which consists of a 2500 gpm diesel driven fire pump a jockey pump and a dedicated water supply. The 2500 gpm pump is not part of the Technical Specification requirements and is isolated from the main yard loop. The backup fire protection system and the main plant fire protection system can be cross-tied. Separation by distance ensures a fire in the circulating water pump house will not damage this pump.



## 4.2 AUTOMATIC WET PIPE SPRINKLER SYSTEMS

Wet pipe sprinkler systems are selected to provide primary suppression capability for various areas.

Wet pipe sprinkler systems are designed in accordance with NFPA 13. Each sprinkler system in the area of safety related equipment consists of an alarm valve assembly, an alarm device, piping, and fusible element sprinkler heads.

Wet pipe sprinkler systems operate when ambient temperature rises to the melting point of fusible links on sealed sprinkler heads, thus permitting the heads to open. Flow of water through alarm check valves actuates a pressure switch and registers an alarm condition on an audible-visual annunciator on the fire protection control panel in the control room. Once initiated, wet pipe sprinkler operation is terminated manually by shutting the outside screw and yoke (OS&Y) gate valves. The systems are restored to a "ready" condition by replacing the sprinkler heads that operated and reopening the OS&Y valves.

### 4.3 DRY PIPE SPRINKLER SYSTEMS

Dry pipe sprinkler systems are selected to provide primary suppression capability for various areas. Dry pipe sprinkler systems are designed in accordance with NFPA 13. The dry pipe sprinkler systems are selected for areas where low temperatures may occur, thus avoiding freezing of sprinkler piping.

Dry pipe sprinkler systems use automatic sprinkler heads attached to a piping system that contains air under pressure. The system operation is initiated by the melting of fusible links, which allows a sprinkler head to open and release the air. Loss of air pressure permits the water pressure to open the dry pipe valve. Activation of the system operates a pressure switch and registers an alarm condition on an audible-visual annunciator on the fire protection control panel in the control room. After operation, the dry pipe sprinkler system is reset by manually closing the OS&Y gate valve, draining the system, replacing all sprinkler heads that operated, resetting dry pipe valve, and repressurizing the pipe with air, before reopening the OS&Y valve.

#### 4.4 AUTOMATIC PREACTION SPRINKLER SYSTEMS

Automatic preaction sprinkler systems are selected to provide primary fire suppression capability for various plant areas.

When automatic sprinkler protection is provided in areas containing safety-related equipment, preaction sprinkler systems are provided to reduce the risk of possibly flooding the area in the event of a pipe failure.

Preaction sprinkler system operation is initiated by sensors which detect a rapid temperature rise, a fixed high temperature, and/or presence of products of combustion (Ionization or Photoelectric detectors). The initiation sensors and local circuits may be shared with the fire detection system described in Section 4.12. The sensor releases a tripping device to open the deluge valve, permitting water to flow into the sprinkler piping system. When the fusible links holding the sprinkler heads closed melts, water will discharge from the sprinkler head. A pressure switch will sense water flow and register an alarm condition on an audible-visual annunciator on the fire protection control panel in the control room. After operation, the preaction sprinkler system is reset by closing the OS&Y gate valve, draining the system, replacing all sprinkler heads that operated, resetting the preaction valve, and repressurizing the pipe with air, before reopening the OS&Y valve.

#### 4.5 DELUGE SYSTEMS

Deluge systems provide fire suppression capability for various areas.

Deluge systems are automatic open-head water spray systems using heat detectors to open the deluge valve. The individual systems may be manually activated from a local pushbutton switch and a manual control station. Some of the deluge systems can also be manually activated from the control room.

The heat detectors, which control the deluge valves, will open when temperatures in the protected area rise at an abnormally high rate or reach a fixed temperature. Heat detector actuation is indicated on a local panel and annunciated on the control room panel. Deluge systems are reset by closing the OS&Y gate valve, draining the system, resetting the deluge valve and reopening the OS&Y valve.

#### 4.6 WET STANDPIPES AND HOSE STATIONS

Wet standpipes were designed and installed for Class II service using the guidance of NFPA 14.

Hose stations are strategically located throughout the plant using the guidance of NFPA 14. The minimum residual pressure at the highest hose station in the plant is at least 65 psig with 100 gpm flowing. Each hose station in the power block contains 100 ft. of 1-1/2 inch fire hose with an appropriate nozzle. Hose stations located in areas of the plant where there is electrical equipment are provided with electrically safe fog nozzles, with the exception of the fire hose nozzles in the Fire Zone 0-8A, where straight stream nozzles are provided.

The site Fire Brigade is trained in fighting fires using hose stations and actions to be taken should additional fire hose be required. Areas exist in the plant where the installed 100' fire hose at the hose station may not be sufficient to fully reach all extents of the area. For those areas, high rise fire hose packs are available for Fire Brigade use.

#### 4.7 PORTABLE FIRE EXTINGUISHERS

Portable fire extinguishers are selected to provide either primary or backup fire suppression capability depending on the particular area. They are located throughout the plant.

The exact number, type, and location of each extinguisher has been determined using the guidelines of NFPA 10.

Portable fire extinguishers are provided at the containment during refueling and major maintenance operations.

#### 4.8 CARBON DIOXIDE SYSTEMS

Low pressure carbon dioxide (CO<sub>2</sub>) systems provide primary fire suppression capability in the electrical equipment rooms as shown on the drawings in Section 8.0.

The low pressure carbon dioxide systems are designed using the guidelines of NFPA 12, "Carbon Dioxide Extinguishing Systems". The design quantity of the agent is based on 50 percent concentration in the hazard area. The storage tank can supply double shot fire protection to the largest hazard plus four shots for generator purging.

The two types of CO<sub>2</sub> systems in use are automatic total flooding and manual spurt.

The automatic total flooding system is actuated by heat detectors. A predischage alarm sounds locally in normally occupied areas and in the control room. HVAC system penetrations into the area are sealed off by CO<sub>2</sub> operated fire dampers. Spearmint odorizer cartridges are provided in all automatic flooding and manual spurt systems for indicating the discharge or presence of CO<sub>2</sub>.

Manual spurt systems are provided to protect cables in concealed spaces on the control room level.

Ionization detectors in the hazard areas actuate the audible and visual alarm on the main fire protection control panel.

Since it is desirable for the operators to remain in the control room, the manual spurt system allows the operators to control the release of CO<sub>2</sub> in the vicinity of the control room. Once the operator activates the manual spurt system, a discharge alarm is sounded in the control room. In addition to the audible alarm, odorizer cartridges provide indication of actuation (CO<sub>2</sub> Flow).

#### 4.9 HALON EXTINGUISHING SYSTEMS

Power Generation Control Complex (PGCC) modules are provided with self-contained Halon 1301 fire extinguishing systems. Each system includes pressurized cylinders containing liquefied Halon 1301 at ambient temperature, product-of-combustion detectors (ionization), thermal detectors, spray nozzles, control panel, battery backup, and manual pull station. Each PGCC module cable way is sealed at point of connection. Thermal detectors activate automatic discharge of Halon to the panel and floor sections. The PGCC floor sections are provided with a 20% concentration by volume for a 20 minute duration. Each system alarms locally and in the control room upon activation. The Halon 1301 system is designed using the guidelines of NFPA 12A.

Reference: NEDO-10466, G. C. Minor, H. R. Clay, "Power Generation Control Complex Design Criteria and Safety Evaluation," Licensing Topical Report, Class 1, Revision 2, March, 1978.



#### 4.10 INSULATION AND JACKETING OF CABLE

Scheduled Class 1E cables at Susquehanna SES as a minimum meet the flame propagation requirements of IEEE-383. Type tests for each type of scheduled Class 1E cable used at Susquehanna SES were performed to the requirements of IEEE-383. Each cable type passed the IEEE-383 vertical flame test. This test used a gas burner flame at 70,000 Btu/hr. These cables self-extinguished or burnt out when the flame source was removed which is the IEEE-383 acceptance criteria for the flame test. Also in accordance with IEEE-383, individually insulated or insulated and jacketed conductors removed from each multiconductor cable, which was type tested, passed a flame resistance test specified in IPCEA S-19-81 Section 6.19.6.

Scheduled Non Class 1E cables used at Susquehanna SES as a minimum meet the flame propagation requirements of IEEE-383 with the possible exception of cables containing PVC. Scheduled Non Class 1E cables may not have been tested to the procedures outlined in IEEE-383, however these cables meet the IEEE-383 acceptance criteria for the flame test. The cables containing PVC, listed in Table 5.0-1, may not have been qualified to the flame propagation requirements of IEEE-383.

Cable insulation and jacketing is evaluated to assure that the use of plastic, elastomeric, combustible materials is minimized.

#### 4.11 RACEWAY WRAPPING

The wrapping material used at Susquehanna SES to wrap cable trays or conduits meets the requirement of 10CFR50, Appendix R, Section III.G.2 which requires that the wrapping material used as a fire barrier be either 1 hour or 3 hour rated except as described in Deviation Request No. 17.

#### 4.12 FIRE DETECTION AND ALARM SYSTEM

The fire and smoke detection system is in compliance with NFPA 72E. An uninterruptable power supply has been provided for the fire and smoke detection system.

The system complies with the requirements of NFPA 72D. The system is located on the fire protection control panels in the control room. The system records the date and time of a fire alarm. The recording identifies the general location of the alarm by unit (Unit 1, Unit 2 or common).

Fire and smoke monitoring, detection, and alarm are accomplished by installed ionization, photoelectric, flame, or thermal detectors. In certain areas of the plant, heat detectors activate fire suppression systems and fire and smoke detection systems provide early warning alarm function only. In other areas of the plant, the fire and smoke detection system provides early warning alarm and activates the preaction system valve.

The fire and smoke detection system is electrically supervised to detect circuit breaks, ground faults, and power failure. All fire or trouble alarms register on the audible-visual annunciator on the fire protection control panel in the control room.

The control room C650 panel provides fire and trouble indication for the CO<sub>2</sub>, smoke detection, sprinkler, deluge, preaction and Halon systems. Individual local panels are provided for each of these systems. In addition to displaying fire and trouble alarms, the local panels provide supervision of detector and release mechanism wiring, and where applicable, provide system activation. Power to panels, except the Halon panels, is provided by separate connections to the uninterruptable power supply, which is described in Subsection 8.3.1.8 of the FSAR. The Halon panels in the power generation control complex are powered by normal a.c. power and are provided with battery packs for backup power.

The control room C650 panel contains fire pump start switches and annunciators to alarm fire pumps operating, AC Power Failure, Motor Overcurrent, Engine Running, Control Switch Not in Auto Position and "trouble" alarms. The control structure smoke removal system graphic display is located on panel OC650 and contains controls for the fans and dampers of this system.

#### 4.13 APPENDIX R VOICE POWERED COMMUNICATION SYSTEM

The Appendix R Voice Powered Communication System provides un-interruptable communication from the Control Room and Remote Shutdown Panel (RSP) to numerous locations throughout the plant where manual actions may be required in the event of postulated fires in various fire zones.

This voice powered communication system consists of headsets with acoustic boom and/or noise-shielded microphone that plug into jack plates. The jackplates are located as shown on Table 4.13-1. The system provides communication for use during Appendix R fire scenarios. No power is required to operate the system.