TECHNICAL REPORT

EVALUATION OF SELECTED FIRE DOOR AND DOOR FRAME ASSEMBLIES

By

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Prepared for:

Pennsylvania Power and Light Company
"Susquehanna Steam Electric Station"
Route 11
Salem Township, Pennsylvania 15635

FM Index No. 38492.55

NS

January 1985

Approved by

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PURPOSE

An evaluation of selected fire doors protecting safety-related areas was conducted for Pennsylvania Power and Light Company (PP&L) at Susquehanna Steam Electric Station Units 1 and 2. The purpose of the evaluation was to examine selected fire doors to determine whether field modifications made to labeled fire doors (doors which have been tested and accepted by a nationally recognized laboratory) since their installation voided the fire resistance rating of the doors; and to examine other nonlabeled door assemblies and render an opinion on their fire resistance rating.

SUMMARY AND CONCLUSIONS

1. The labeled fire door and frame assemblies and the labeled access panel are expected to provide the level of fire resistance stated on the label.
2. The special purpose (water tight) door and frame assembly examined should provide a minimum of 1-1/2 hr fire resistance.
3. To meet FM recommendations ventilation louvers in the doors to the four chases containing electrical panels and cables at elevation 771 of the Control Building should be relocated to the face of the cable chase near the ceiling to achieve fast response.

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I

INTRODUCTION

The plant was visited during January 7 and 8, 1985. The writer was accompanied by Messrs. T. Baileys, PP&L Fire Protection Engineer, and L. J. Mattern, FMEA, Resident Loss Prevention Specialist. Sixty-six doors and door frames, one labeled access panel, and one unlabeled special-purpose door were examined during this visit. These assemblies were located in the Control Building and Unit 1 and Unit 2 Reactor Buildings.

The writer is a Project Engineer with 20 years experience at Factory Mutual Research Corporation (FMRC). His primary responsibility is: 1) testing and determination of fire rating for fire doors; and 2) examination of installed unlabeled doors to determine their fire resistance rating for building authorities. The writer has served on the National Fire Protection Association "Fire Door and Window" Committee (NFPA 80) for 18 years.

II

FIRE DOOR EVALUATION

Labeled fire doors and door frames, a labeled access panel, and an unlabeled special purpose door and frame were examined during this visit to Susquehanna Steam Electric Station at the request of Pennsylvania Power and Light Company (PP&L).

2.1 FIRE DOORS AND DOOR FRAME ASSEMBLIES AND ACCESS PANELS

Sixty-six doors and door frames and one access panel were examined to determine whether 1) labels were in place and properly attached, 2) modifications had been made to the door or panel, and 3) modifications made would void the fire resistance rating of the door or panel.

Of the 66 doors examined, 62 doors were labeled, 4 doors were not labeled or had labels loosely attached. Forty-two of the labeled fire doors had been modified.

2.1.1 Labeled Doors with No Modifications

Labeled doors were visually examined to determine that there was no physical damage to the door and that hardware supplied as part of the assembly functioned properly to close and latch the door when the door was released from the open position.

Fire door assemblies which have not been modified should have the fire resistance rating indicated on the label.

2.1.2 Labeled Fire Doors and Panel with Modifications

Fire door and door frame assemblies which have been tested by a nationally recognized laboratory, such as Factory Mutual Research Corporation (FMRC) or Underwriter's Laboratories (UL), have a label attached to both the door and the frame. The fire resistance rating is noted on the label.

A generally accepted precept of FMRC and UL is that any alteration of the assembly from the successfully fire tested construction voids the fire resistance rating indicated on the label. However, there are reasons in the nuclear industry for modifying a fire door assembly; a major reason is security. Care must be used when adding security hardware to the door and/or frame to assure that this hardware will have minimum impact on fire resistance rating of the assembly.

In the examination, fire door assemblies with modifications had one or more of the following additions or alterations:

1. Switches or electromagnets attached to the header of the door frame. Wiring is in rigid metal conduit from the card reader to the face of the door frame.
2. Steel or aluminum angle strips 2 in. to 4 in. wide, 1/8 in. thick, and 4 in. to 6 in. long attached to the top of the door by machine screws. The angle strips act in concert with the switch or electromagnet.
3. Weather stripping used to minimize air leakage around doors where a pressure differential exists between adjoining areas. Weather stripping was attached to the door or door frame by means of machine screws.

The labeled fire doors examined are identified in Appendix A. Also included in this Appendix are comments on additions/modifications to doors and frames.

A 1-1/2 hr labeled access panel No. 7006 is located in the Control Building at elevation 754. The panel is 3 ft by 3 ft and is equipped with a microswitch on the frame.

Modifications made to labeled fire doors and frames and the access panel are not expected to affect the fire resistance rating of these assemblies.

2.1.3 Fire Doors Not Labeled

Door No. 111 (elevation 670, Reactor Bldg. Unit 1) and Door No. 201 (elevation 683, Reactor Bldg. Unit 1) had no labels. These doors were compared with Door No. 110 (elevation 670, Reactor Bldg, Unit 2) which had a 1-1/2 hr label with the following results:

1. All three had the same dimensions (height, width and thickness) and the same identification tags (except for the opening number) riveted to the latch edge of the door.
2. The spacing of internal horizontal stiffeners was determined to be approximately 8 to 12 in. on center on all three doors. This was done by means of a stethoscope.

3. The same type of insulation was used in the core of all three doors (glass fiber batts). This was established by removing screws from door hinges on all doors and extracting door filler material.
4. The thickness of the metal face sheet on all doors was the same (0.045 in. or 18 ga). This was determined by measuring metal thickness by means of a specially adapted micrometer.

Door No. 115 (elevation 670 of Reactor Bldg. Unit 1) also had no label. This door was apparently designed as a bullet proof door with hinges welded in place. It could not be internally examined in the manner described above. The door was manufactured by the Chicago Bullet Proof Door Company. Other doors made by the same company were located in the Control Building (Door 462 at elevation 729) and in the Reactor Building (Door 571 at elevation 818). Both the above doors have 1-1/2 hr labels. All three doors have 1) the same dimensions, 2) the same hardware, 3) a solid core. Based on the writer's experience auditing fire door manufacturing plants it is believed that Door No. 115 would also have a 1-1/2 hr fire rating. However, since the door could not be internally examined, the manufacturer would have to be contacted and asked to compare the construction of this door with the 1-1/2 hr fire rated doors to confirm the above.

Door 587 had a loosely attached label. This door would normally be treated as if it had no label. The door was not physically examined as above because it was located in a short corridor with a labeled fire door on either side (Door 586 and a stairway door).

2.2 SPECIAL PURPOSE DOOR

An evaluation was made of an unlabeled special-purpose (flood) door to determine whether it would provide a 1-1/2 hr fire resistance rating. The door examined was at elevation 645 in the Core Spray Pump Room of Unit 1. This area is indicated as Area 1-1B in the "Fire Protection Review Report".

The door was 3 ft by 7 ft and consisted of 1/4 in. plate steel with 1 in. x 2 in. x 3/16 in. steel channel for peripheral framing and horizontal stiffening 10 in. on center. The door was latched by twelve 1 in. square, steel bar latches engaging the 5/8 in. thick steel frame on the top, bottom and sides. Gasketing is employed to make a waterproof seal with the 5/8 in. thick steel frame.

Steel doors of this type have not been tested for fire resistance in this country. The construction of this door was compared to the Rules of the Fire Offices' Committee (FOC), Section 1, Specification 1, from Great Britain,

which states that doors fabricated in accordance with those rules may be expected to provide 6 hrs' fire resistance when there is one door on each side of the opening. This is based on numerous successful fire tests of these doors in that configuration.

Fire tests on single doors of this design, conducted to requirements of British Standard 476, Part 8, have satisfied requirements of that standard for 2 hours. This test method is equivalent to the test procedure used in the U.S., ASTM E-152, in determining a door's fire resistance rating, with one exception: a hose stream test is not required in BS476. This exception is not considered critical for steel doors since the hose stream is applied to the hinge side of the door which drives the door against the frame stop.

Rules of the FOC require two point latches of no less than 3/8 in. diameter steel in such doors. The waterproof door in question has twelve 1 in. square steel latch bars which engage the frame; hence, the desired 1-1/2 hr fire resistant performance can reasonably be expected in a fire situation.

2.3 ELECTRICAL EQUIPMENT CHASES

An evaluation was made of doors to chases containing electrical equipment at elevation 771 in the Control Building. These doors were numbered 594, 595, 598, and one unnumbered. The doors are fitted with a fusible link-actuated louver (11 in. x 11 in.) located in the top third of the door. The doors and louvers bore 1-1/2 hr UL labels.

FM does not approve labeled fire doors with louvers. However, UL tests and lists louvers for installation in labeled fire doors. The National Fire Protection Association (NFPA) allows the use of louvers in labeled fire doors where the opening is not in an exit or located where products of combustion flowing through the louver opening prior to its operation could jeopardize the use of exits.

The wall construction of the cable chases consists of two 1 in. thick layers of Type X gypsum wallboard on steel studs. The wallboard is on the corridor side only with no sheathing provided on the chase side of the studs. This is not a tested fire rated construction.

To meet FM recommendations louvers should be relocated to the face of the cable chase near the ceiling to achieve fast response. Louver openings in the door should be closed with 16 gage sheet metal with a minimum 2 in. overlap around the opening. The sheet metal covering should be attached with machine screws 5 in. on center.

The construction of the electrical equipment chase is such that a 1-1/2 hr fire resistance can be expected if fire exposure is on the corridor side. However, if the fire exposure came from within the chase, fire resistance rating would be minimal. Expansion of the exposed steel studs due to a fire inside would result in movement of fasteners holding the gypsum wallboard in place with possible loss of structural integrity of the wall.

III

RECOMMENDATIONS

Eight door assemblies in Control and Reactor Buildings, require the following:

1. Door No. 115 (Elevation 670, Reactor Building, Unit 1): The manufacturer should be contacted to determine the fire rating of this door.
2. Door No. 559, Elevation 771, Control Building: The latch mechanism on this fire exit device needs repair. Latching is not reliable and bolt retraction is erratic.
3. Door No. 586, Elevation 783, Control Building: This door was prepared for a dead bolt which has not been provided. The 1 in. diameter hole in the face sheet should be covered with 16 gage sheet metal fastened with machine screws.
4. To meet FM recommendations ventilation louvers in the doors to the four chases containing electrical panels and cables at Elevation 771, Control Building (Doors No. 594, 595, 598, and one unnumbered) should be relocated to the face of the cable chase near the ceiling to achieve fast response. Louver openings in the door should be closed with 16 gage sheet metal with a minimum 2 in. overlap around the opening. The sheet metal should be attached with machine screws 5 in. on center.
5. Door No. 601, Elevation 779 Reactor Building: One bolt attaching the frame to the wall is missing and should be replaced. Also, the closer attachment to the frame header is loose and should be tightened.

APPENDIX A
FIRE DOOR OBSERVATIONS

BUILDING	DOOR NO.	ELEV-ATION	DOOR LABELED	MODIFICATIONS: None	Card Reader	Weather Stripped	Other (Comments)	COMMENTS
CONTROL BLDG	263	698	Yes		X			
	317	698	Yes		X			
	457	729	Yes		X			
	462	729	Yes		X		X	
	463	729	Yes	X				
	465	729	Yes	X				
	466	729	Yes	X				
	468	729	Yes	X				
	538	754	Yes		X			
	542	754	Yes	X				
	544	754	Yes	X				
	553	771	Yes			X		
	554	771	Yes			X		
	555	771	Yes			X		
	556	771	Yes			X		
	557	771	Yes			X		
	558	771	Yes			X		
	559	771	Yes			X		See Section III
	560	771	Yes			X		
	561	771	Yes			X		
	562	771	Yes			X		
	563	771	Yes			X		
	564	771	Yes			X		
	567	771	Yes			X		
	568	771	Yes			X		
	569	771	Yes			X		
	570	771	Yes			X		
	571	771	Yes			X		
	572	771	Yes			X		
	573	771	Yes			X		
	580	783	Yes	X				
	585	783	Yes	X				
	586	783	Yes				X	See Section III

APPENDIX A
FIRE DOOR OBSERVATIONS

BUILDING	DOOR NO.	ELEV-ATION	DOOR LABELED	MODIFICATIONS: None	Card Reader	Weather Stripped	Other (Comments)	COMMENTS
CONTROL BLDG	587	783	(See Note 1)	X				
	594	771	Yes			X		See Section III
	595	771	Yes			X		See Section III
	598	771	Yes			(See Note 2)		See Section III
	730	806	Yes			X		
	731	806	Yes		X	X		
	7006	754	Yes				X	Microswitch on frame,(see Note 3)
REACTOR BLDG UNIT 1	70	670	Yes		X			
	109	670	Yes			X	X	Extra heavy duty hinges
	111	670	No	X				Appears same as Door No. 110 (elev. 670 Reactor Bldg. Unit 2).
	115	670	No		X			Appears same as Door No. 462 (elev. 729 Control Bldg.) and Door No. 571 (elev 818 Reactor Bldg.)
	201	683	No	X				Appears same as Door No. 110 (elev. 670 Reactor Bldg. Unit 2)
	415	719	Yes	X				
	419	719	Yes	X				
	421	719	Yes	X				
	425	719	Yes	X				
	517	749	Yes	X				
	519	749	Yes	X				
	523	749	Yes	X				
	525	749	Yes	X				
	571	818	Yes		X	X		
	601	779	Yes	X				See Section III
	627	779	Yes		X	X		
	803	818	Yes		X	X		
	806	818	Yes			X		
	807	818	Yes		X	X		

APPENDIX A
FIRE DOOR OBSERVATIONS

BUILDING	DOOR NO.	ELEV-ATION	DOOR LABELED	MODIFICATIONS: None	Card Reader	Weather Stripped	Other (Comments)	COMMENTS
REACTOR BLDG UNIT 2	72	670	Yes	X				
	110	670	Yes	X				
	112	670	Yes	X				
	113	779	Yes			X	X	Air lock switch
	114	779	Yes			X	X	Air lock switch
	116	670	Yes		X	X		
	518	749	Yes				X	New closer reinforcement on face of door

NOTES:

1. The label on this door has minor damage and is loosely attached. This casts a question as to its legitimacy. In this instance, the question is moot, as this location is in a short corridor with an acceptable fire door on either side of it. (Door No. 586 and a stairway door.)
2. There is a fourth door adjacent to this door with no opening identification.
3. This is a 3 ft x 3 ft, 1-1/2 hr rated access panel.

SUSQUEHANNA STEAM ELECTRIC STATION - UNITS 1 & 2
FIRE PROTECTION PROGRAM - CONCERN #1
DOCKETS NO. 50-387
50-388

APPENDIX A - EXEMPTION REQUESTS

EXEMPTION REQUEST NO. 3

ATTACHMENT 2

Factory Mutual System

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August 16, 1985

Mr. Thomas Gorman
Nuclear Plant Engineering
A-63
Pennsylvania Power and Light Company
Two North Ninth Street
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Subject: Fire Door Evaluation

Dear Mr. Gorman:

The following is the report of Sam Knight's visit on May 7, 1985 to evaluate fire resistance of four doors and frames in the Unit 1 and 2 Reactor Buildings.

Very truly yours,

Paul H. Dobson
Senior Engineer

PHD/jmj

cc: D. Kohn, PP&L
P. H. Dobson, FMRC
L. J. Matern, FMEA - Phil.
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