

TECHNICAL REPORT

EVALUATION OF SELECTED FIRE DOOR AND DOOR FRAME ASSEMBLIES
(SUPPLEMENT 2)

By

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Prepared for:

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"Susquehanna Steam Electric Station"
Route 11
Salem Township, Pennsylvania 15635

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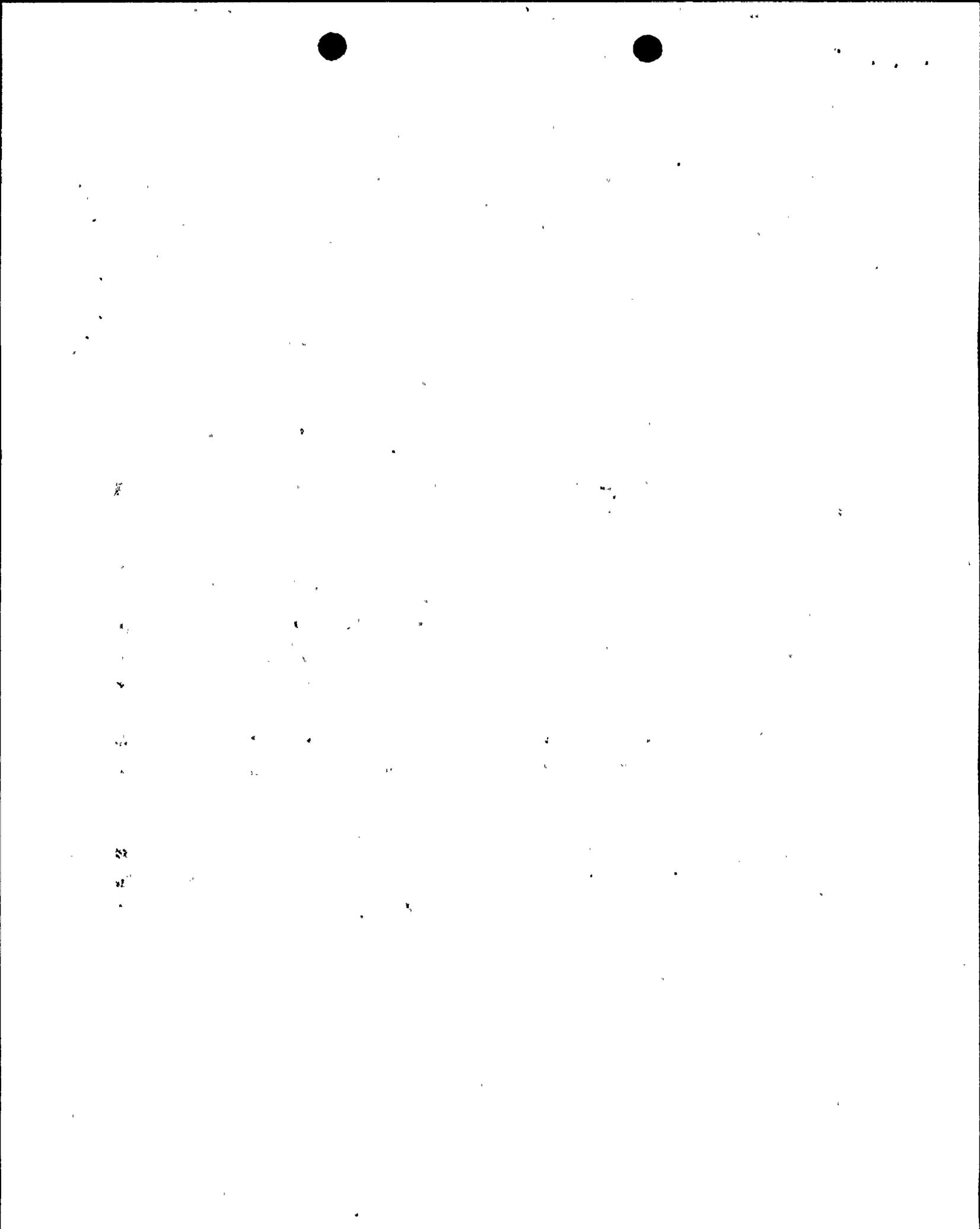


Factory Mutual Research

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SUMMARY AND CONCLUSIONS

An evaluation of selected fire doors protecting safety related areas was conducted for the Pennsylvania Power & Light Company (PP&L) at Susquehanna Steam Electric Station, Units 1 & 2. The purpose of the evaluation was to examine certain unlabeled doors and compare them with labeled door construction, and render an opinion on their expected fire resistance.

This evaluation was requested by PP&L as a supplement to the original evaluation in a Factory Mutual report dated January 1985, and Supplement 1, dated August 1985.

The following conclusions were reached:

1. Door 112 on Level 670 may be expected to provide 3 hours of fire resistance.
2. Door 202 on Level 683 may be expected to provide 3 hours of fire resistance.
3. Door 407 on Level 719 may be expected to provide 3 hours of fire resistance when the four 1/8 in. diameter holes in the face sheet are sealed with sheet metal screws.
4. Door 514 on Level 749 may be expected to provide 1-1/2 hours of fire resistance. If the existing latch bolt is replaced with a latch having a 3/4 in. throw, this door may be expected to provide 3 hours fire resistance.
5. Door 530 on Level 761 may be expected to provide 1-1/2 hours of fire resistance. If the existing latch bolt is replaced with a latch having a 3/4 in. throw, this door may be expected to provide 3 hours fire resistance.
6. Door 711 on Level 799 may be expected to provide 1-1/2 hours of fire resistance. If the existing latch bolt is replaced with a latch having a 3/4 in. throw, this door may be expected to provide 3 hours fire resistance.

I

INTRODUCTION

The Susquehanna Steam Electric Station was visited on April 4, 1986 and May 16, 1986. The writer was accompanied by Mr. S. E. Davis of PP&L; Mr. L. J. Mattern of FMEA was present during the April visit. Three unlabeled doors and frames were examined during each visit. The door assemblies are located in Unit 1 & 2 Reactor Buildings.

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

II

FIRE DOOR AND FRAME EVALUATION

Six unlabeled fire doors and frames were examined during two visits to the Susquehanna Steam Electric Station at the request of the Pennsylvania Power & Light Company (PP&L). Expected fire resistance ratings for each door were determined through comparison with labeled doors.

2.1 FIRE DOOR FRAMES

All frames are fabricated in accordance with the American National Standards Institute, Standard A155.1, and may be expected to provide 3 hours of fire resistance.

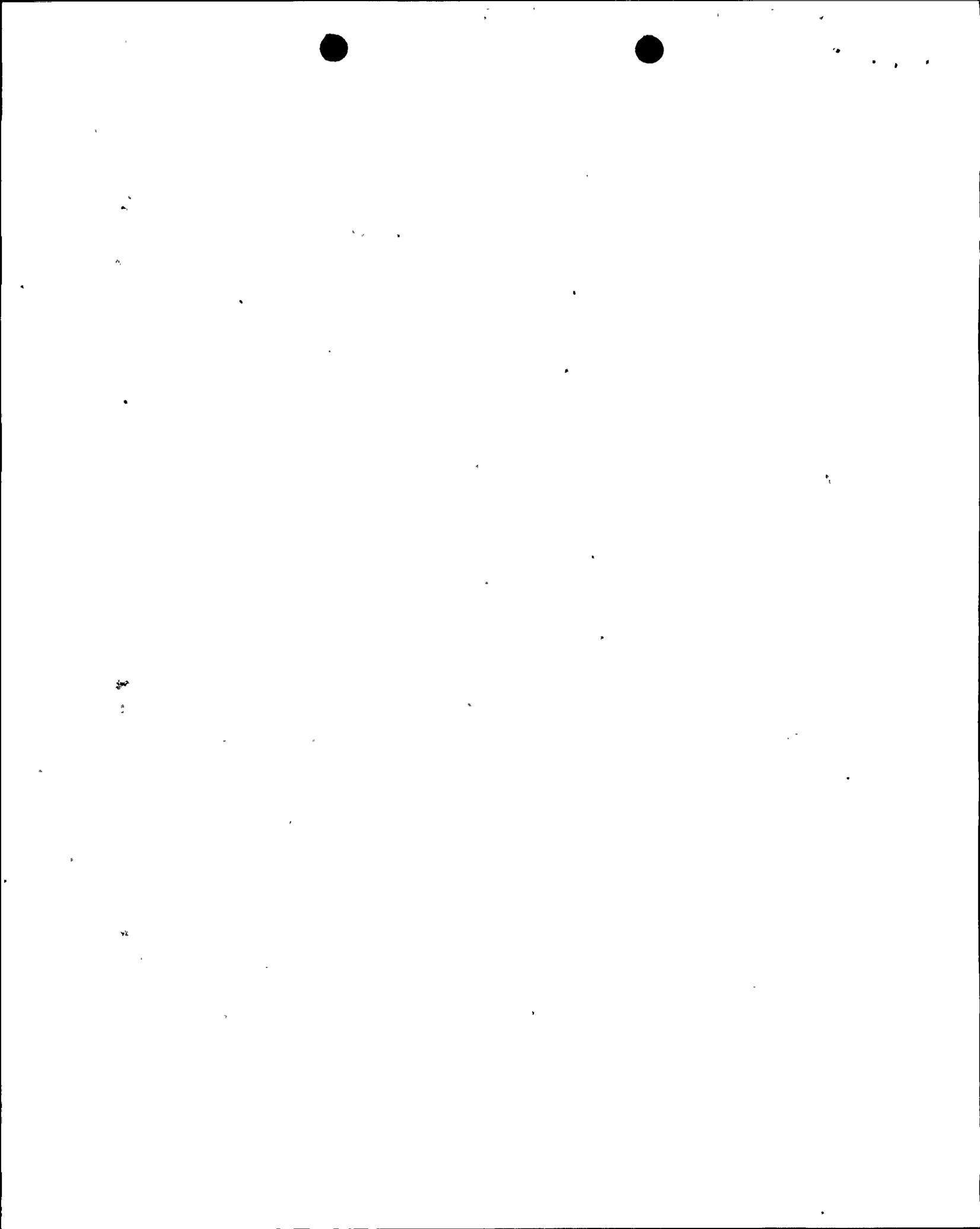
2.2 FIRE DOORS

The following unlabeled fire doors were examined by comparing their construction features with labeled fire doors.

2.2.1 Door 112

Door 112 on Level 670 was compared to Door 421, a 3-hour labeled door on Level 719; it is concluded that Door 112 has an expected 3-hour rating based on the following results:

1. Both doors are the same size.
2. Internal stiffeners in both doors are 6 to 8 in. on center. This was determined by means of a stethoscope.
3. Face sheets, hinge reinforcements and peripheral channel framing are essentially the same. Measurements were made using a specially adapted micrometer. In addition latch throws in Door 670 are equal to or greater than the 3-hour labeled door.
4. Door 421 has a low-density glass fiber insulation in the door cavity while Door 112 does not. This low density insulation has no significant bearing on the performance of a door in a fire situation.



2.2.2 Door 202

Door 202 on Level 683 was examined and its construction details were compared with those of Door 110 a 1-1/2-hour (subsequently upgraded to 3 hours) labeled door on Level 670; it is concluded that Door 202 has an expected 3-hour rating based on the following observations:

1. Both doors are the same size.
2. Internal stiffeners in both doors are 6 to 8 in. on center.
3. Face sheets, hinge reinforcements and peripheral channel framing have the same measurements. The 3-hr rated door has a 3/4 in. latch throw, whereas Door 202 has a 1/2 in. throw; however, because Door 202 employs a three point latch mechanism, (i.e. three points of engagement between door and frame) it is concluded that this mechanism offsets the shorter throw and justifies extending the expected fire resistance rating to 3 hours.

2.2.3 Door 407

Door 407 on Level 719 was examined to compare its construction details against Door 421, a 3-hour labeled fire door on Level 719; it is concluded that Door 407 has an expected 3-hour rating based on the following observations:

1. The labeled door is 2 in. higher than Door 407. Tests have shown that doors smaller than tested will provide equivalent performance if all other construction features are the same.
2. Internal stiffeners in both doors are 6 to 8 in. on center.
3. Faces sheets, hinge reinforcements and peripheral channel framing are the same, except there are four holes of approximately 1/8 in. diameter in one face sheet of Door 407. In addition, latch throws in Door 407 are equal to or greater than Door 421.

2.2.4 Door 514

Door 514 on Level 749 was examined to compare its construction details against Door 421, a 3-hour labeled fire door on Level 719; it is concluded that Door 514 has an expected 3-hour rating based on the following observations:



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1. Both doors are the same size.
2. Internal stiffeners in both doors are 8 to 12 in. on center.
3. Face sheets, hinge reinforcements, and peripheral channel framing are essentially the same.
4. The labeled door is fitted with a single point latch having a $3/4$ in. throw, while Door 514 has a $5/8$ in. throw. Although the construction of Door 514 is comparable with the 3-hour rated door, this shorter latch throw dictates a shorter expected fire resistance of 1-1/2 hours. Since greater forces are generated in the assembly during a 3-hour exposure, there is increased possibility that the shorter latch bolt will be pulled out of the strike during expansion and distortion of the door and frame, resulting in failure. Experience has shown that if the construction of the door is adequate, a 1/2-in. latch throw is adequate to achieve a 1-1/2-hour expected fire resistance. If the 5/8-in. bolt is replaced with a 3/4-in. bolt, the door may be expected to provide up to 3 hours fire resistance.

2.2.5 Door 530

Door 530 on Level 761 was examined to compare its construction details against Door 421, a 3-hour labeled fire door on Level 719; it is concluded that Door 530 has an expected 3-hour rating based on the following evidence:

1. Both doors are of the same size.
2. Internal stiffeners in both doors are 8 to 12 in. on center.
3. Face sheets, hinge reinforcements and peripheral channel framing are essentially the same.
4. The labeled door is fitted with a single point latch having a $3/4$ in. throw, while Door 530 has a $5/8$ in. throw. Although the construction of Door 530 is comparable with the 3-hour rated door, this shorter latch throw dictates a shorter expected fire resistance of 1-1/2 hours. Since greater forces are generated in the assembly during a 3-hour exposure, there is increased possibility that the shorter latch bolt will be pulled out of the strike during expansion and distortion of the door and frame, resulting in failure. Experience has shown that if the construction of



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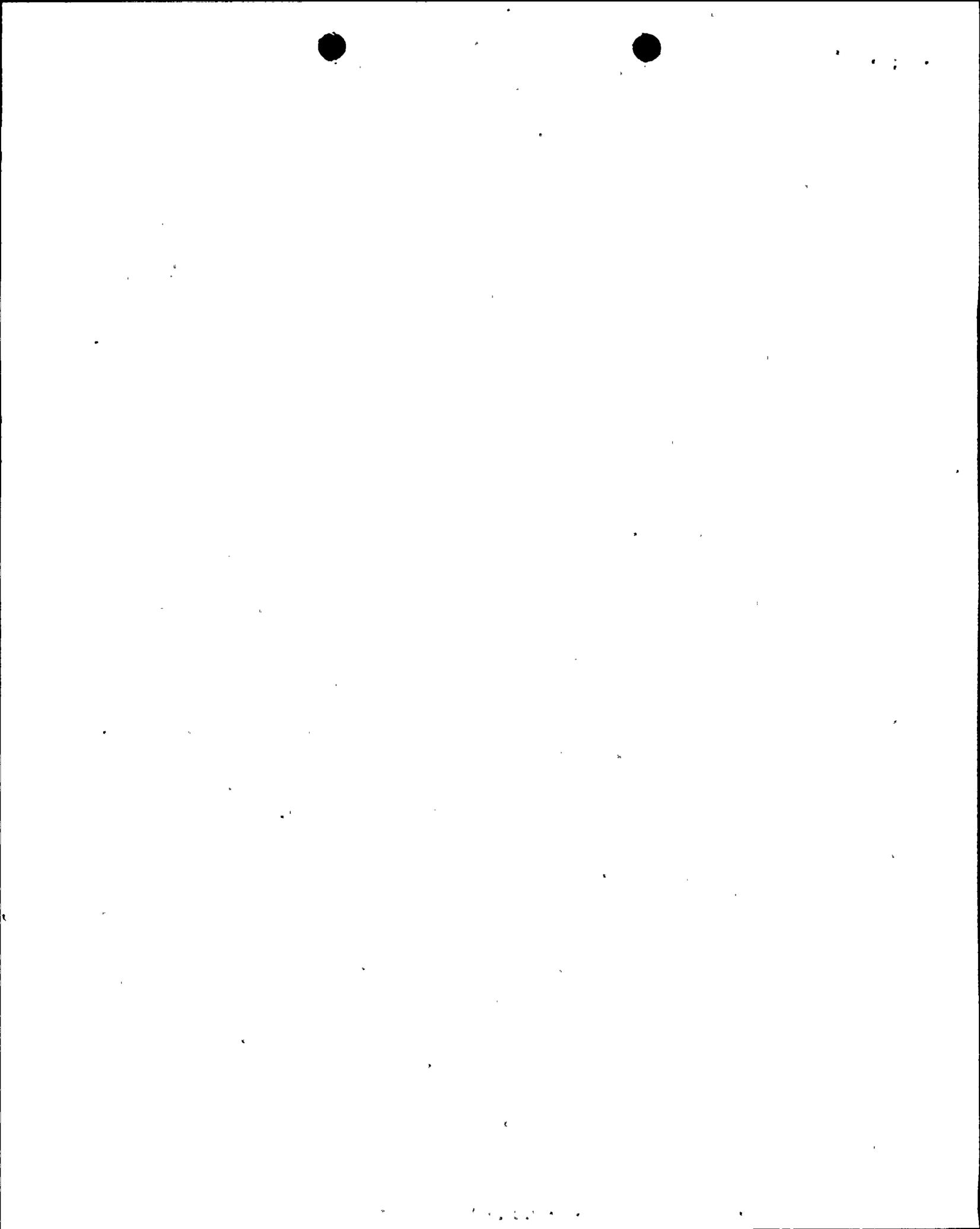
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the door is adequate, a 1/2-in. latch throw is adequate to achieve a 1-1/2-hour expected fire resistance. If the 5/8-in. bolt is replaced with a 3/4-in. bolt, the door may be expected to provide up to 3 hours fire resistance.

2.2.6 Door 711

Door 711 on Level 799 was examined to compare its construction details against Door 421, a 3-hour labeled fire door on Level 719; it is concluded that Door 711 has an expected 3-hour rating based on the following evidence:

1. Door 711 was 6 in. narrower than Door 799. Tests have shown that doors smaller than tested will provide equivalent performance if all other construction details are the same.
2. Internal stiffeners are 8 to 12 in. on center.
3. Face sheets, hinge reinforcements and peripheral channel framing are essentially the same.
4. The labeled door is fitted with a single point latch having a 3/4 in. throw, while Door 711 has a 5/8 in. throw. Although the construction of Door 711 is comparable with the 3 hr. rated door, this shorter latch throw dictates a shorter expected fire resistance of 1-1/2 hours. Since greater forces are generated in the assembly during a 3-hour exposure, there is increased possibility that the shorter latch bolt will be pulled out of the strike during expansion and distortion of the door and frame, resulting in failure. Experience has shown that if the construction of the door is adequate, a 1/2-in. latch throw is adequate to achieve a 1-1/2-hour expected fire resistance. If the 5/8-in. bolt is replaced with a 3/4-in. bolt, the door may be expected to provide up to 3 hours fire resistance.



III

RECOMMENDATIONS

1. To obtain a 3-hour fire resistance rating the four 1/8-in. diameter holes in the face sheet of Door 407 on Level 719 should be filled using sheet metal screws.
2. To increase the 1-1/2-hour fire resistance rating to 3 hours, the 5/8 in. throw latch bolts on Door 514 on Level 749; Door 530 on Level 761; and Door 711 on Level 799 should be replaced with latch bolts having a 3/4 in. throw.

DEVIATION REQUEST NO. 3

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

APPENDIX A - DEVIATION REQUESTS

DEVIATION REQUEST NO. 3

ATTACHMENT 4