



Commonwealth Edison

One First National Plaza, Chicago, Illinois

Address Reply to: Post Office Box 767

Chicago, Illinois 60690

June 1, 1984

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: LaSalle County Station Units 1 and 2
Fire Protection - Fire Detection Report
NRC Docket Nos. 50-373 and 50-374

- References (a): LaSalle County Station Unit 2 Facility
Operating License NPF-18, Attachment 1E.1.
- (b): C. W. Schroeder letter to H. R. Denton
dated November 23, 1983.
- (c): Inspection Report Nos. 50-373/83-44 and
50-374/83-48.
- (d): C. W. Schroeder letter to H. R. Denton
dated March 9, 1984.

Dear Mr. Denton:

The attached report regarding the fire detection at LaSalle completes the analysis of the fire detector installation. It covers the safety-related areas not previously included: the diesel generator rooms (covered by automatic total-flooding CO2 systems) and their oil tank rooms (covered by automatic wet pipe sprinkler protection). Updated information for inclusion in Interim Reports No. 1 and No. 3 is also attached.

These four reports have reviewed the installation of 1333 detectors in 88 fire zones (including 81 sprinklers in the ten DG oil tank rooms). Commonwealth Edison plans to replace or relocate 42 of these and to add an additional 26 detectors as a result of the analyses. The modifications will improve the response capability of the detection system. The current installation, however, has been judged adequate and no compensatory measures are now required. These modifications will be completed prior to startup following the first Unit 2 refueling outage.

Distribution of copies of this letter and the attachments is as follows:

Federal Express original letter and one copy of the reports
to Dr. A. Bournia, NRR.

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June 1, 1984

Federal Express one copy of letter and one copy of the report to J. G. Keppler, Region III.

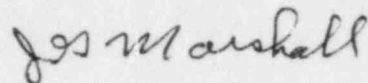
H. R. Denton, nine (9) copies of letter and attachments.

J. G. Keppler two (2) copies of letter and attachments.

M. Jordan (NRC Resident Inspector) one copy of letter and attachments.

If there are any further questions regarding this matter, please contact this office.

Very truly yours,



J. G. Marshall
Nuclear Licensing Administrator

lm

- Attachments 1: Schirmer Eng. Corp. Rept. No. 4 dated May 14, 1984.
- 2: Errata - 15 change pages to Schirmer Report No. 1 dated February 21, 1984.
- 3: Errata - 8 change pages to Schirmer Report No. 3 dated March 8, 1984.

8708N

Schirmer

SCHIRMER ENGINEERING CORPORATION
707 LAKE COOK ROAD
DEERFIELD, ILLINOIS 60015-4997
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FIRE PROTECTION ENGINEERS
SAFETY ENGINEERS
CODE CONSULTANTS

FINAL REPORT
INTERIM REPORT NO. 1
ANALYSIS OF FIRE DETECTOR LOCATIONS
AT
LA SALLE COUNTY STATION

SEC Project No. 83118

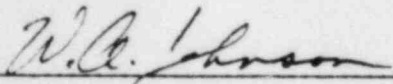
FOR
SARGENT & LUNDY ENGINEERS
AND
COMMONWEALTH EDISON COMPANY

FEBRUARY 21, 1984

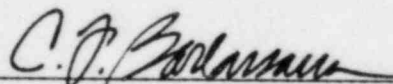
REVISED: MAY 24, 1984

Prepared By:

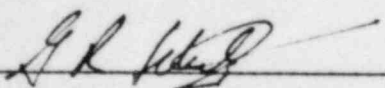
Reviewed By:



W.A. Johnson



C.F. Baldassarra, P.E.



G. R. Schultz, P.E.

TABLE I
SMOKE DETECTOR ANALYSIS SUMMARY

Area	No. of Detectors Installed	No. of Detectors to be Added	No. of Detectors to be Relocated
Control Room			
Units 1 & 2 (4C1)	43	0	0
Auxiliary Electric Equipment Rooms ¹			
Unit 1 (4E1-1)	5	0	0
Unit 1 (4E1-2)	9	0	0
Unit 2 (4E2-1)	3	0	0
Unit 2 (4E2-2)	10	0	2
Switchgear Rooms			
Unit 1, Division 2 (4E3) ¹	19	1	1
Unit 2, Division 2 (4E4) ¹	19	1	0
Unit 1, Division 1 (4F1)	21	0	1
Unit 2, Division 1 (4F2)	21	0	2
HPCS Switchgear Rooms			
Unit 1, Division 3 (5D1)	5	0	0
Unit 2, Division 3 (5D2)	5	0	0
TOTAL	<u>160</u>	<u>2</u>	<u>6</u>

1. Does not include the three detectors installed outside the physical barriers of the Auxiliary Electric Equipment Rooms that are being reconnected to the Switchgear Room systems. This would involve a total of 6 detectors.

TABLE 2
AVERAGE AREA PER DETECTOR

Area (Description)	Area (Square Feet)	Ceiling Height (ft.-in.)	Design Air Changes per hr.	No. of Detectors Installed	Average Area/Det. (Square Feet)	Recommended Area/Det. per NFPA 72E-1982 (Square Feet)
Control Room Units 1 & 2 Fire Zone 4C1	6,720	16-6	9	43	156	875
Auxiliary Electric Equipment Room Unit 1 Fire Zone 4E1-1	683	17-0	41	5	137	220
Fire Zone 4E2-2	1,363	17-0	12	9	151	620
Auxiliary Electric Equipment Room Unit 2 Fire Zone 4E2-1	403	17-0	68	3	134	100
Fire Zone 4E2-2	1,643	17-0	15	10	164	500
Switchgear, Unit 1 Division 2 Fire Zone 4E3	3,550	17-0	24	19	187	300
Switchgear, Unit 2 Division 2 Fire Zone 4E4	3,550	17-0	24	19	187	300
Switchgear, Unit 1 Division 1 Fire Zone 4F1	3,420	19-8	26	21	162	300
Switchgear, Unit 2 Division 1 Fire Zone 4F2	3,425	19-8½	26	21	163	300

CONTROL ROOM, UNITS 1 AND 2 (FIRE ZONE 4C1)

Existing Conditions

The Control Room (Fire Zone 4C1) is located at elevation 768 feet, 0 inches between columns J-N and 12-18. It encompasses an area of approximately 6,720 square feet. The walls defining this area are structural reinforced concrete having a 3-hour fire rating. Door openings are protected by labeled Class A (3-hour) fire doors. The concrete ceiling/floor slab is approximately 16 feet, 6 inches above the floor. Both the floor slab and the ceiling slab are 3-hour rated assemblies.

This fire zone is served by redundant HVAC systems to maintain inside temperature of $73^{\circ} \pm 1^{\circ}\text{F}$ all year round. Redundant ionization-type smoke detectors are provided in the return air passage from this zone. Detection of smoke causes 100 percent recirculation of ventilation air through a recirculation charcoal absorber, and annunciation in the Control Room. Area ionization detectors are also provided in this zone. Provisions are made to purge this zone by 100 percent outdoor air through a manual control switch located on the main control panel.

The ventilation system is designed to discharge directly into the Control Room proper through a louvered ceiling suspended below the slab above. It has been designed for 9 air changes per hour.

The Control Room is the primary control center for the station. All safety-related systems, reactor shutdown, and cooling systems have indication and control in this zone. The Control Room is important to safe reactor operation. Because of the consequences of a fire, the defense-in-depth concept has been imposed in such a manner as to emphasize:

- a. the minimization of any probability of ignition occurring;
- b. the rapid detection and extinguishment of any postulated fire; and

- c. redundant plant shutdown capability is provided in the Auxiliary Electric Equipment Rooms (Zones 4E1 and 4E2).

The Control Room is continuously manned and smoke detectors are provided throughout the area and in the ductwork. Manual fire fighting equipment consists of two CO₂ hose reels with 100 feet of UL listed hose, two fire hose stations with 100 feet each of 1½-inch UL listed hose, one fire hose station with 50 feet of 1½-inch UL listed hose, five Class 20B:C portable fire extinguishers, and two Class 2A-20B:C portable fire extinguishers.

The possibility of a fire occurring and developing into a significant size without detection by either the automatic detection system or personnel is highly unlikely. All of the smoke detectors provided in this room are ionization-type detectors. Forty-three smoke detectors are currently installed, yielding an average area per detector of 156 square feet. Detectors are strategically located in areas of cable concentration and are between 1 foot, 4 inches and 3 feet, 1 inch below the ceiling. Beams deeper than 18 inches have been partially embedded into the ceiling slab. This reduces the effective depth by 1 foot, 3 inches. Room details are illustrated in Drawing Number 4C1, Sheets 1-3, in Appendix B.

Velometer readings were taken at the detectors and measurable airflow was present at only two detectors. These detectors are located adjacent to the return air grilles. The velometer readings are shown in Table 3.

The Control Room was surveyed on January 12 and 17, 1984. The following Sargent & Lundy drawings were reviewed in the evaluation of the smoke detection system:

<u>Drawing No.</u>	<u>Revision</u>	<u>Dated</u>
S-579	Y	2/29/80
S-1077	AE	1/26/83
M-1390, Sheet 1	P	1/15/82
M-1390, Sheet 2	L	5/28/82
1E-O-3931A	B	12/21/82
1E-O-3931B	C	3/21/83
1E-1-3165	H	5/18/78
1E-2-3165	C	5/18/78

Corrective Action

The smoke detectors, as installed, are acceptable. The rationale for acceptance has been outlined in a previous section of this report. As a means of summation, the following issues were evaluated in making this decision:

- a. The room is continuously manned. Any fire is likely to be rapidly detected.
- b. Any fires that may occur would most likely be of a slow-developing nature.
- c. Due to the high ceiling, stratification of smoke will occur at some level below the ceiling.
- d. Air at the detectors and above is stagnant as demonstrated by velometer readings. Airflow in the room is essentially confined to the lower portion of the room.
- e. In the unlikely event of a fast-developing fire near the floor, the plentiful products of combustion will be sensed effectively by personnel and/or detectors in the present locations.
- f. The average area per detector is well within the guidelines of NFPA 72E (Table 2).

The velometer readings presented in Table 3 indicate a total of two detectors with measurable airflow. Detectors OXY-1-5-05 and OXY-2-5-16 experienced flow, however, they are located to favor the return air stream. The location of these detectors should aid in sensing smoke originating from some other point in the room.

The NRC has requested additional smoke detectors be provided below the suspended ceiling level in the control panels. The existing detection system should effectively sense a fire originating in this area and no corrective action is recommended.

Automatic fire detection is provided in the room and in its ductwork. Fire walls are used to prevent the spread of fire. Manual fire fighting equipment consists of one fire hose station with 50 feet of 1½-inch UL listed hose, one CO₂ hose reel with 100 feet of UL listed hose, one Class 2A-20B:C portable fire extinguisher and three Class 20B:C portable fire extinguishers.

The smoke detectors provided in this room are ionization-type detectors. Five smoke detectors are located in Fire Zone 4E1-1 and nine smoke detectors are located in Fire Zone 4E1-2. This results in an average area per detector of 137 and 151 square feet, respectively. Detectors are strategically located in areas of cable concentration and are between 3 feet, 2 inches and 4 feet, 4 inches below the ceiling. Velometer readings were taken at the detectors and are summarized in Table 4. Beams deeper than 18 inches exist. Room details are illustrated in Drawing Number 4E1 in Appendix B.

Three smoke detectors (OXY-1-27-15 through 17), installed within the boundaries of Fire Zone 4E3 have been connected to this zone. It is recommended that they be reconnected into Zone 4E3. These detectors do not appear on the drawings but are installed in the area directly east of Fire Zone 4E1. This should assist in simplifying an operator's response, since the operator will not have to evaluate two zones.

The Auxiliary Equipment Room, Unit 1, was surveyed on January 11, 1984. The following Sargent & Lundy drawings were reviewed in the evaluation of the smoke detection system.

<u>Drawing No.</u>	<u>Revision</u>	<u>Dated</u>
S-575	Z	7/2/82
M-1389, Sheet 1	AF	3/18/83
1E-O-3933C	A	7/14/82
1E-1-3145	3	8/4/80

Corrective Action

The smoke detectors in this zone, with the exception of the three detectors to be rewired, are acceptable. The rationale for acceptance has been outlined in a previous section of this report. As a means of summation, the following issues were evaluated in making this decision:

- a. Any fires that may occur would most likely be of a slow-developing nature.
- b. Due to the high ceiling, stratification of smoke will occur at some level below the ceiling.
- c. Air at the detectors and above is stagnant as demonstrated by velometer readings. Airflow in the room is essentially confined to the lower portion of the room.
- d. In the unlikely event of a fast-developing fire near the floor, the plentiful products of combustion will be sensed effectively by detectors in the present locations.
- e. The average area per detector is within the guidelines of NFPA 72E (Table 2).

The velometer readings presented in Table 4 indicate a total of three detectors with measurable airflow. The flow for detector OXY-1-27-03 is considered negligible. Detectors OXY-1-27-05 and OXY-1-27-06 have significant flows but they are located to favor the return air stream. The location of these detectors will aid in sensing smoke originating anywhere in the room.

The three detectors, OXY-1-27-15, OXY-1-27-16 and OXY-1-27-17 should be reconnected into Fire Zone 4E3. Their physical location is acceptable but the recommendation is made in order to simplify the operator's response. If one of these detectors were to actuate the operator may investigate within the physical boundaries of the Auxiliary Electric Equipment Room and not investigate the additional detectors.

TABLE 4
AUXILIARY ELECTRIC EQUIPMENT, UNIT 1, VELOMETER READINGS
(Fire Zone 4E1)

Detector Number	Detector Dimension Below Ceiling	Velometer Readings	
		Location	Reading
OXY-1-27-01	4 feet, 4 inches	@ Detector	No measurable airflow
OXY-1-27-02	4 feet, 4 inches	@ Detector	No measurable airflow
OXY-1-27-03	4 feet, 5 inches	@ Detector	20 FPM, flowing down
OXY-1-27-04	4 feet, 6 inches	@ Detector	No measurable airflow
OXY-1-27-05	4 feet, 6 inches	@ Detector	180 FPM, flowing west
OXY-1-27-06	3 feet, 2 inches	@ Detector	350 FPM, flowing west
OXY-1-27-07	4 feet, 5½ inches	@ Detector	No measurable airflow
OXY-1-27-08	4 feet, 5½ inches	@ Detector	No measurable airflow
OXY-1-27-09	3 feet, 8 inches	@ Detector	No measurable airflow
OXY-1-27-10	4 feet, 1½ inch	@ Detector	No measurable airflow
OXY-1-27-11	4 feet, 1½ inches	@ Detector	No measurable airflow
OXY-1-27-12	4 feet, 2 inches	@ Detector	No measurable airflow
OXY-1-27-13	4 feet, 2 inches	@ Detector	No measurable airflow
OXY-1-27-14	4 feet, 3 inches	@ Detector	No measurable airflow
OXY-1-27-15 ¹	4 feet, 5½ inches	@ Detector	No measurable airflow
OXY-1-27-16 ¹	4 feet, 5½ inches	@ Detector	No measurable airflow
OXY-1-27-17 ¹	4 feet, 5½ inches	@ Detector	No measurable airflow

1. These detectors are connected to Zone 4E1, but should be rewired to Fire Zone 4E3.

Automatic fire detection is provided in the room and in its ductwork. Fire walls are used to prevent the spread of fire. Manual fire fighting equipment consists of one fire hose station with 50 feet of 1½-inch UL listed hose, one CO₂ hose reel with 100 feet of UL listed hose, one Class 2A-20B:C portable fire extinguisher and three Class 20B:C portable fire extinguishers.

The smoke detectors provided in this room are ionization-type detectors. Three smoke detectors are located in Fire Zone 4E2-1 and 10 smoke detectors are located in Fire Zone 4E2-2. This provides for an average area per detector of 134 and 164 square feet, respectively. Detectors are strategically located in areas of cable concentration and are located between 2 feet, 5 inches and 3 feet, 8 inches below the ceiling. Velometer readings were taken at the detectors and are summarized in Table 5. Beams deeper than 18 inches exist. Room details are illustrated in Drawing Number 4E2 in Appendix B.

Three smoke detectors (OXY-2-27-09 through 11), installed within the boundaries of Fire Zone 4E4 have been connected to this zone. It is recommended that they be reconnected into Zone 4E4. These detectors do not appear on the drawings but are installed in the area directly east of Fire Zone 4E2. This should assist in simplifying an operator's response, since the operator will not have to evaluate two zones.

The Auxiliary Equipment Room, Unit 2, was surveyed on January 10 and 12, 1984. The following Sargent & Lundy drawings were reviewed in the evaluation of the smoke detection system.

<u>Drawing No.</u>	<u>Revision</u>	<u>Dated</u>
S-1073	AD	9/30/83
M-1389, Sheet 2	Z	3/25/83
1E-O-3933B	A	6/30/82
1E-2-3145	3	8/4/80

Corrective Action

The locations of 11 of 13 smoke detectors, as presently installed, are acceptable. This count does not include the rewiring of the three detectors from this zone to Zone 4E4. The rationale for acceptance has been outlined in a previous section of this report. As a means of summation, the following issues were evaluated in making this decision:

- a. Any fires that may occur would most likely be of a slow-developing nature.
- b. Due to the high ceiling, stratification of smoke will occur at some level below the ceiling.
- c. Air at the detectors and above is stagnant as demonstrated by velometer readings. Airflow in the room is essentially confined to the lower portion of the room.
- d. In the unlikely event of a fast-developing fire near the floor, the plentiful products of combustion will be sensed effectively by detectors in the present locations.

The 134 square feet per detector in Fire Zone 4E2-1, although greater than the recommended spacing per NFPA 72E, is acceptable. The 134 square feet spacing is not considered a deficient value as the actual air movement at the level of the detectors is not significant. The zone is actually interconnected with Zone 4E2-2, thereby providing a total of 15 air changes per hour for the entire area. These adjacent detectors will also serve to sense a fire in this zone.

The velometer readings presented in Table 5 indicate a total of 4 detectors with measurable airflow. The flow for detector OXY-2-27-01 was upward thereby helping the smoke originating at or near the floor reach the detector. Its present location is acceptable. Detector OXY-2-27-04 is located directly in the supply air stream. It should be relocated approximately 3 feet, 6 inches south, where the air velocity is much lower. The airflow at detector OXY-2-27-05 was considerable, but measurements of airflow in other possible alternate locations in the vicinity were greater. Its present location is acceptable. Detector OXY-2-27-08 is located in a supply air stream. It should be relocated to a point about 3 feet west.

The three detectors, OXY-2-27-09, OXY-2-27-10 and OXY-2-27-11 should be reconnected into Fire Zone 4E4. Their physical location is acceptable but the recommendation is made in order to simplify the operator's response. If one of these detectors were to actuate the operator may investigate within the physical boundaries of the Auxiliary Electric Equipment Room and not investigate the additional detectors.

TABLE 5
AUXILIARY ELECTRIC EQUIPMENT ROOM, UNIT 2, VELOMETER READINGS
(Fire Zone 4E2)

<u>Detector Number</u>	<u>Detector Dimension Below Ceiling</u>	<u>Velometer Readings</u>	
		<u>Location</u>	<u>Reading</u>
OXY-2-27-01	3 feet, 8 inches	@ Detector	30 FPM, flowing up
OXY-2-27-02	3 feet, 7 inches	@ Detector	No measurable airflow
OXY-2-27-03	2 feet, 5 inches	@ Detector	No measurable airflow
OXY-2-27-04	3 feet, 1 inch	@ Detector	505 FPM, flowing east
OXY-2-27-05	3 feet, 1 inch	@ Detector	120 FPM, flowing east
OXY-2-27-06	3 feet, 7 inches	@ Detector	No measurable airflow
OXY-2-27-07	3 feet, 7 inches	@ Detector	No measurable airflow
OXY-2-27-08	3 feet, 7 inches	@ Detector	155 FPM, flowing north
OXY-2-27-09 ¹	3 feet, 4 inches	@ Detector	No measurable airflow
OXY-2-27-10 ¹	3 feet, 7 inches	@ Detector	No measurable airflow
OXY-2-27-11 ¹	3 feet, 6 inches	@ Detector	No measurable airflow
OXY-2-27-12	3 feet, 6 inches	@ Detector	No measurable airflow
OXY-2-27-13	3 feet, 6 inches	@ Detector	No measurable airflow
OXY-2-27-14	3 feet, 7 inches	@ Detector	No measurable airflow
OXY-2-27-15	3 feet, 7½ inches	@ Detector	No measurable airflow
OXY-2-27-16	3 feet, 7 inches	@ Detector	No measurable airflow

1. These detectors are connected to Zone 4E2, but should be rewired to Fire Zone 4E4.

- b. Due to the high ceiling, stratification of smoke will occur at some level below the ceiling.
- c. Air at the detectors and above is stagnant as demonstrated by velometer readings. Airflow in the room is essentially confined to the lower portion of the room.
- d. In the unlikely event of a fast-developing fire near the floor, the plentiful products of combustion will be sensed effectively by detectors in the present locations.
- e. The average area per detector is well within the guidelines of NFPA 72E (Table 2).

The velometer readings presented in Table 6 indicate a total of 4 detectors with measurable airflow. Detector OXY-1-8-10 was in the supply air stream and should be relocated 1 foot, 6 inches south. The flow for Detector OXY-1-8-09 was upward thereby helping smoke originating at the floor reach the detector. The present location is acceptable. Detector OXY-1-8-12 experienced flow in a northwest direction. The magnitude of airflow is not considered sufficient to degrade detector performance. Detector OXY-1-8-08 experienced flow in an easterly direction. Its position favors the return air plenum in this vicinity and is acceptable.

An additional detector should be provided 5 feet, 6 inches east of column N and 8 feet, 0 inches north of column 10. This detector would reduce the area between detectors OXY-1-8-01 and OXY-1-8-09 and also provide detection favoring the return air stream in the room.

Three detectors (Detectors OXY-1-27-15, OXY-1-27-16 and OXY-1-27-17) connected to the detection system for the Auxiliary Electrical Equipment Room should be reconnected to this zone. The detection system, where possible, should coincide with the physical barriers of the fire zone. The current location of these three detectors is acceptable.

Corrective Action

The smoke detector locations, as installed, are acceptable. The rationale for acceptance has been outlined in a previous section of this report. As a means of summation, the following issues were evaluated in making this decision:

- a. Any fires that may occur would most likely be of a slow-developing nature.
- b. Due to the high ceiling, stratification of smoke will occur at some level below the ceiling.
- c. Air at the detectors and above is stagnant as demonstrated by velometer readings. Airflow in the room is essentially confined to the lower portion of the room.
- d. In the unlikely event of a fast-developing fire near the floor, the plentiful products of combustion will be sensed effectively by detectors in the present locations.
- e. The average area per detector is well within the guidelines of NFPA 72E (Table 2).

The velometer readings in Table 7 indicate a total of 2 detectors with measurable airflow. The airflow for Detectors OXY-2-8-11 and OXY-2-8-13 are not great enough to cause significantly degraded performance. Their locations are acceptable.

Three detectors (Detectors OXY-2-27-09, OXY-2-27-10 and OXY-2-27-11) connected to the detection system for the Auxiliary Electrical Equipment Room should be connected to this zone. The detection system, where possible, should coincide with the physical barriers of the fire zone. The current location of these three detectors is acceptable.

An additional detector should be provided for the Division 1 Riser Room adjacent to the battery room. This detector should be near the north wall under the duct that is between the two pairs of cable trays. It should be located at the highest elevation possible.

CONCLUSION

An engineering survey was made of selected rooms at LSCS to verify the proper location of installed automatic smoke detectors. This analysis demonstrated that, because of the nature of the expected combustibles, the effects of mechanical ventilation and stratification, the locations of 154 of the 160 currently installed smoke detectors meet the guidelines and the intent of NFPA 72E. Current detector locations in the rooms assure adequate fire detector response capability without necessitating compensatory measures. This capability is demonstrated by the more than adequate number of detectors in each of the affected rooms, based upon the recommended area per detector as stated in NFPA 72E (1982).

Recommendations have been made to relocate six detectors, connect six detectors to a different zone and add ~~one~~ additional detectors in order to provide improved response capability.

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Schirmer

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FIRE PROTECTION ENGINEERS
SAFETY ENGINEERS
CODE CONSULTANTS

FINAL REPORT
INTERIM REPORT NO. 3
ANALYSIS OF FIRE DETECTOR LOCATIONS
AT
LASALLE COUNTY STATION

SEC Project No. 83118

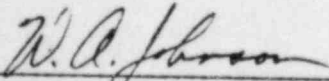
FOR
SARGENT & LUNDY ENGINEERS
AND
COMMONWEALTH EDISON COMPANY

MARCH 8, 1984

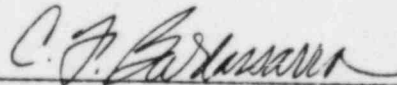
REVISED: MAY 24, 1984

Prepared By:

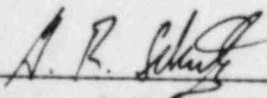
Reviewed By:



W. A. Johnson



C. F. Baldassarra, P.E.



G. R. Schultz, P.E.

TABLE 1
DETECTOR ANALYSIS SUMMARY

Area	No. of Detectors Installed ¹	No. of Detectors to be Added	No. of Detectors to be Relocated/ Replaced
Area 1	16	0	0
Unit 2 Reactor Building (3B1) Elevation 870 feet, 0 inches	14	0	0
Unit 1 Reactor Building (2B1) Elevation 870 feet, 0 inches	14	0	0
Unit 2 Reactor Building (3B2) Elevation 820 feet, 6 inches	11	0	0
Unit 1 Reactor Building (2B2) Elevation 820 feet, 6 inches	11	0	0
Unit 2 Reactor Building (3C) Elevation 807 feet, 0 inches	9	0	0
Unit 1 Reactor Building (2C) Elevation 807 feet, 0 inches	9	0	0
Unit 2 Reactor Building (3D) Elevation 786 feet, 6 inches	44	0	0
Unit 1 Reactor Building (2D) Elevation 786 feet, 6 inches	45	0	0
Unit 2 HPCS Cubicle (3H2) Elevation 694 feet, 6 inches	3	1	0
Unit 1 HPCS Cubicle (2H2) Elevation 694 feet, 6 inches	3	1	0
Unit 2 RHR Heat Exchanger B Cubicle (3H3) Elevation 694 feet, 6 inches	5	0	0
Unit 1 RHR Heat Exchanger B Cubicle (2H3) Elevation 694 feet, 6 inches	5	0	0

TABLE I
DETECTOR ANALYSIS SUMMARY
(Continued)

Area	No. of Detectors Installed ¹	No. of Detectors to be Added	No. of Detectors to be Relocated/ Replaced
Unit 1 Division 2 Diesel Ventilation Equipment Room (7A2)	8	0	0
Unit 1 Division 1 Diesel Ventilation Equipment Room (7A3)	8	0	0
Unit 2 HPCS Diesel Pump Room (8C3)	4	0	0
Unit 1 HPCS Diesel Pump Room (7C4)	7	0	0
Unit 2 Division 2 RHR Service Water Pump Room (8C4)	5	0	0
Unit 1 Division 2 RHR Service Water Pump Room (7C5)	6	0	1
Unit 2 Division 1 RHR Service Water Pump Room (8C5)	5	0	0
Unit 1 Division 1 RHR Service Water Pump Room (7C6)	6	0	0
Off-Gas Filter Building (10A1) Elevation 710 feet, 6 inches	4	0	0
Off-Gas Filter Building (10B1) Elevation 690 feet, 0 inches	7	0	0
Unit 2 Reactor Building (3E) Elevation 761 feet, 0 inches	0	1 ²	0
Unit 1 Reactor Building (2E) Elevation 761 feet, 0 inches	0	1 ²	0
TOTAL	<u>564</u>	4 ² <u>2</u>	9 ² <u>2</u>

1. Includes licensing conditions for Unit 1.
2. Additional detector added to zone included in Interim Report No. 2. See text in this report.

FIRE ZONE 3H2 - HPCS CUBICLE

Fire Zone 3H2 is the HPCS Cubicle, located at elevation 694 feet, 6 inches in the Unit 2 Reactor Building and encompasses an area of 1,200 square feet. Three ionization detectors are installed yielding an average area per detector of 400 square feet. The ceiling is less than 16 feet above the floor. Detectors are mounted directly to the concrete ceiling. Detector OXY-2-32-03 is located approximately 3 feet above the corner of a 40,000-CFM fan, designed to discharge into the area below. Measureable airflow was present at detector OXY-2-32-03. It experienced a flow of 585 FPM toward the fan inlet. Its present location should aid in sensing smoke originating in the room.

The 40,000 CFM fan draws air continuously from the elevation above and discharges to the elevation below and therefore is causing the room to experience high air changes per hour. The quantity of air changes is above the values represented in the NFPA 72E-1982 edition figure defining spacing requirements (Figure A-9-3.5.1.A). However, average air velocity within the room is not unreasonably high to preclude detection. Combustibles in this room are extremely light but the potential does exist for a transient load to be stored in the room in an area not covered by a detector. An additional detector should be provided 13 feet south of detector OXY-2-32-05.

The following Sargent & Lundy drawings were reviewed in the evaluation of the smoke detection system.

<u>Drawing No.</u>	<u>Revision</u>	<u>Dated</u>
S-709	Z	5/23/83
M-1366, Sheet 2	F	5/17/82
IE-0-39353	A	3/31/83

The fire to be detected in this area would be the 55 gallon drum of lube oil discussed in interim Report No. 2. Although air changes are higher than that contemplated by NFPA 72E it is felt that the current spacing, with the addition of the one detector, represents a practical minimum spacing. The current installation will be acceptable with the addition of one detector.

Fire Zone 2H2 is the similar area in Unit 1. Three ionization detectors are installed directly to the concrete ceiling. Detector OXY-1-32-03 is located approximately 3 feet above and 3 feet south of a 40,000-CFM fan, designed to discharge into the air below. The ventilation system operates in the same manner as discussed above. An additional detector should be provided 12 feet east of detector OXY-1-32-05.

The following Sargent & Lundy drawings were reviewed in the evaluation of the smoke detection system.

<u>Drawing No.</u>	<u>Revision</u>	<u>Dated</u>
S-209	AF	7/2/82
M-1365, Sheet 2	L	3/22/82
IE-0-3935B	B	12/21/82
IE-1-3206	D	3/14/80

Based upon a drawing review and a walk-through, the existing installation (with the addition of one detector) is acceptable.

FIRE ZONE 3I2 - UNIT 2 HPCS CUBICLE

Fire Zone 3I2 is the HPCS Cubicle, located at elevation 673 feet, 4 inches, in the Unit 2 Reactor Building and encompasses an area of 1,200 square feet. Six ionization detectors are installed yielding an average area per detector of 200 square feet. The ceiling is greater than 16 feet above the floor. Detectors are mounted directly to the concrete ceiling with the exception of one detector, which is located 1 foot below the ceiling. Measureable airflow was observed at detector OXY-2-30-05. This detector is located outside the CRD enclosure, directly in front of the louvered wall. It will not be relocated because it would be impossible to relocate so that it remains in the vicinity and out of the airstream. It may not sense a fire originating at the floor in the HPCS portion of the room. Detector OXY-2-30-09 experienced a flow of 211 FPM toward the adjacent return grille. It should serve to sense smoke originating elsewhere in the room.

The 40,000 CFM fan takes air from Zone 3H2 and forces it down to fire zone 3I2 to serve as ventilation air for the CRD pumps. The air then travels through a louver to a return grille located at the ceiling in the corner of this zone (3I2). The return grille is ducted to exhaust into the general area (3H1) at elevation 694 feet, 6 inches.

The zone is divided by the louvered wall. The 40,000 CFM fan discharges directly into the portion of the room with the CRD pumps. Due to the large volume of air being discharged into the room, the detection system installed in the CRD pump area will not detect a fire when the fans are running. Smoke must reach the detector to actuate it and the 40,000 CFM would tend to keep the smoke at floor level and significantly dilute its concentration.

The following Sargent & Lundy drawings were reviewed in the evaluation of the smoke detection system.

<u>Drawing No.</u>	<u>Revision</u>	<u>Dated</u>
S-707	V	1/26/83
M-1368, Sheet 2	F	2/9/82
IE-0-3939C	B	12/21/82
IE-2-3201	B	6/17/83

The fire to be detected in this area would be the 55 gallon drum of lube oil discussed in Interim Report No. 2. Although the room air changes per hour are higher than that specified in NFPA 72E-1982 Figure A-9-3-5.1.A, the installation is considered acceptable. Three detectors are installed in the vicinity of the HPCS pump provided an average area per detector of 114 square feet. It is felt that this represents a practical minimum spacing.

Fire Zone 2I2 is the similar area in Unit 1. Seven ionization detectors are installed in the zone. The following Sargent & Lundy drawings were reviewed in the evaluation of the smoke detection system.

<u>Drawing No.</u>	<u>Revision</u>	<u>Dated</u>
S-207	AE	12/30/81
M-1367, Sheet 2	J	3/22/82
IE-0-3939B	A	7/14/82
IE-1-3201	E	10/7/77

Based upon a drawing review and a walk-through, the existing installation is acceptable. The same comment regarding the fan also applies in this zone.

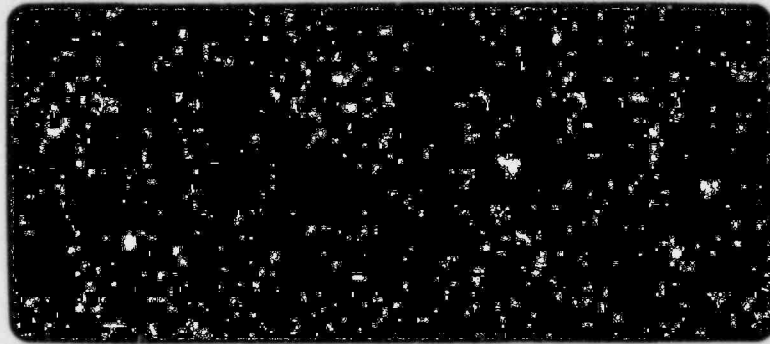
CONCLUSION

An engineering survey was made of selected rooms at LSCS to verify the proper location of installed automatic fire detectors. This analysis demonstrated that, because of the nature of the expected combustibles, the effects of mechanical ventilation and stratification, the locations of 555 of the 564 installed detectors meet the guidelines and the intent of NFPA 72E. An additional four detectors have been recommended. Current detector locations in the rooms assure adequate fire detector response capability without necessitating compensatory measures.

Recommendations have been made to relocate nine detectors to provide improved response capability.

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