

# NRC Research and Technical Assistance Report

EGG-EA-5514

July 1981

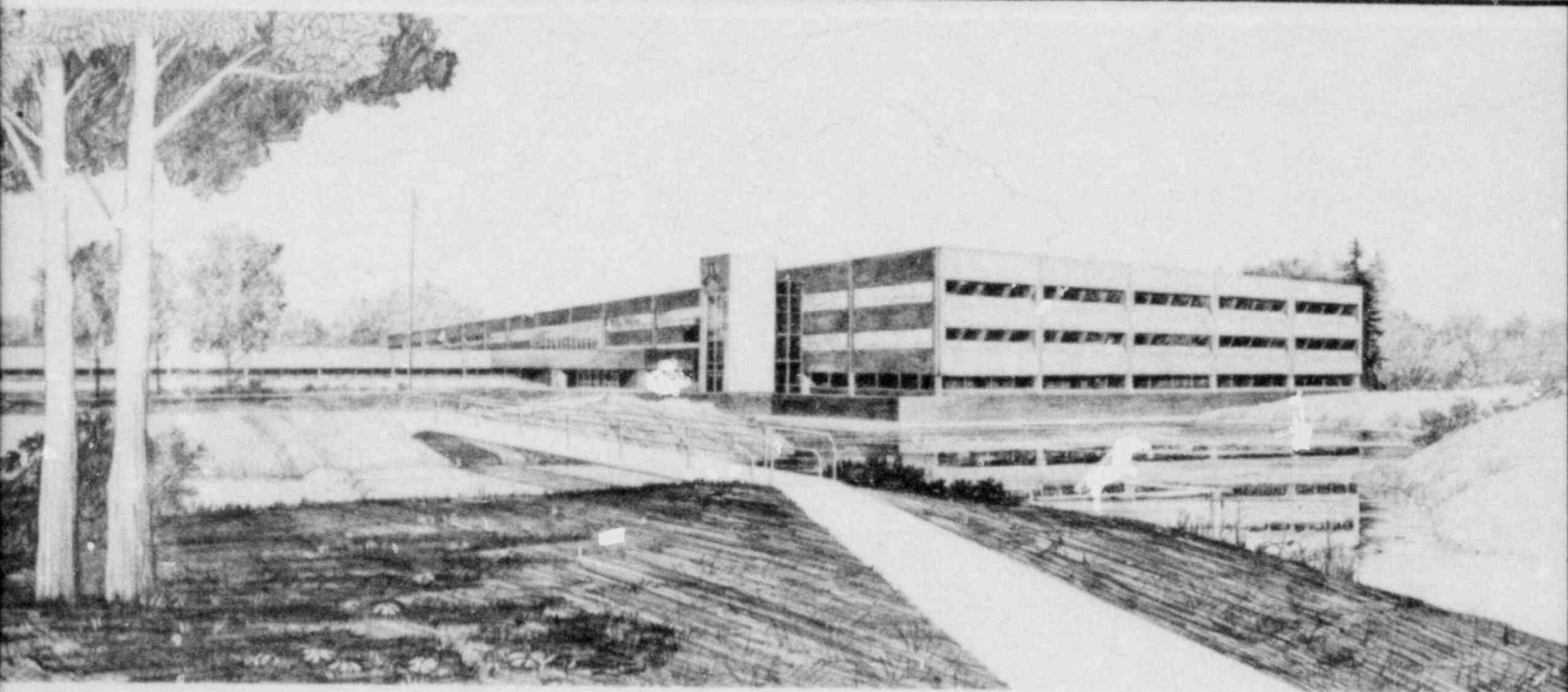
AUDIT OF THE ENVIRONMENTAL QUALIFICATION OF  
SAFETY-RELATED ELECTRICAL EQUIPMENT AT THE  
LA SALLE COUNTY STATION (UNIT 1)

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## U.S. Department of Energy

Idaho Operations Office • Idaho National Engineering Laboratory



This is an informal report intended for use as a preliminary or working document

Prepared for the  
U.S. Nuclear Regulatory Commission  
Under DOE Contract No. DE-AC07-76ID01570  
FIN No. A6453

8109080248 810731  
PDR RES  
8109080248 PDR



## INTERIM REPORT

Accession No. \_\_\_\_\_  
Report No. EGG-EA-5514

**Contract Program or Project Title:**

Equipment Qualification Case Reviews

**Subject of this Document:**

Audit of the Environmental Qualification of Safety-Related Electrical Equipment at the La Salle County Station (Unit 1)

**Type of Document:**

Technical Evaluation Report

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**Date of Document:**

July 1981

## NRC Research and Technical Assistance Report

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Idaho Falls, Idaho 83415

Prepared for the  
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Washington, D.C.  
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## INTERIM REPORT

AUDIT OF THE ENVIRONMENTAL QUALIFICATION OF  
SAFETY-RELATED ELECTRICAL EQUIPMENT AT THE  
LA SALLE COUNTY STATION (UNIT 1)

Docket No. 50-373

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Reliability and Statistics Branch  
Engineering Analysis Division  
EG&G Idaho, Inc.

NRC Research and Technical  
Assistance Report

## ABSTRACT

The La Salle County Station (Unit 1) was audited to determine the environmental qualification of safety-related electrical equipment. Results of the audit are summarized in this report.

## FOREWORD

This report is supplied as part of the "Equipment Qualification Case Reviews" being conducted for the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Division of Engineering, Equipment Qualification Branch by EG&G Idaho, Inc., Reliability and Statistics Branch.

The U.S. Nuclear Regulatory Commission funded the work under the authorization, B&R 20-19-04-15, FIN No. A6453.

**NRC Research and Technical  
Assistance Report** ✓

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AUDIT OF THE ENVIRONMENTAL QUALIFICATION OF  
SAFETY-RELATED ELECTRICAL EQUIPMENT AT THE  
LA SALLE COUNTY STATION (UNIT 1)

1.0 INTRODUCTION

On June 15-19, 1981 a team comprised of representatives of the Reliability and Statistics Branch of EG&G Idaho, Inc. and NRC staff conducted an audit of the environmental safety related electrical equipment for the LaSalle County Station (LSCS). The work effort consisted of: (1) a pre-audit review of the licensee's submittal (Ref. 1), (2) an audit of the licensee's central files for selected equipment items, and (3) a visual inspection of the equipment items for which the central files were audited. Qualification deficiencies for individual equipment items are provided in Attachment A. Summaries of the central file reviews are provided in Attachment B.

2.0 EVALUATION

General areas of concern which remain as a result of both the audit and the pre-audit review of the LSCS submittal are as follows:

1. Many of the items requiring qualification for radiation exposure, particularly the NSSS items, did not appear to be qualified.
2. For the NSSS items, much of the qualification was based on minimal testing with the remainder by very general analysis. These general analyses were not then tied to the specific equipment under consideration.
3. For many NSSS items the requirement for operability under accident conditions was not addressed.



4. For some safety related systems the associated electrical equipment (i.e., pump motors) was not considered for qualification. The licensee maintained that since these systems were redundant the equipment associated with them did not need to be qualified.
5. In most cases the period of time for which individual items would remain qualified was not indicated.
6. In many cases the qualification envelope was not adequately defined and the envelopes in the individual summary sheets did not agree with the envelopes for the zones in which various items of equipment were located.
7. All items requiring qualification for demineralized water spray were not specified.
8. In most cases the requirement for aging was not addressed.
9. During the plant inspection some items of electrical equipment were noted which had not been qualified (i.e., terminal blocks and junction boxes).
10. In one location the specified item of equipment had been replaced by one from a different manufacturer.
11. For one item the required test report was not included in the central files.

### 3.0 CONCLUSIONS

As a result of the audit it was concluded that the LSCS environmental qualification of safety-related electrical equipment was not complete. The licensee will re-submit environmental qualification data at a later date, at which time another audit will be performed.

#### 4.0 REFERENCES

1. Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment, NUREG-0588.
2. Environmental Qualification of Electrical Equipment, LSCS-FSAR Amendment 57, Appendix M.



## APPENDIX A

### QUALIFICATION DEFICIENCIES FOR INDIVIDUAL EQUIPMENT ITEMS

The legend for entries in the deficiency column is as follows:

- A - Material aging evaluation, replacement schedules, ongoing equipment surveillance
- M - Margin
- H - Humidity
- P - Pressure
- R - Radiation
- QT - Qualification time
- T - Temperature

# BOP EQUIPMENT

Equipment Description	Manufacturer	Model	Deficiency
(TABLE M.5.1)			
1. Medium Voltage Switchgear <sup>(1)</sup>	Gould/ITE	7.5 HK-500	A,M
2. Motor Control Center <sup>(2)</sup>	Klockner-Moeller	Series 170	QT,R,T,H,A,M
3. Motor Control Center <sup>(2)</sup>	Systems Control	--	A,M,QT,T,H,P
4. Electrical Penetration	CONAX	Custom	QUALIFIED
5. Electrical Penetration	CONAX	Custom	QUALIFIED
6. 5kV Power Cable	Kerite	HTA, FR or NS	QUALIFIED
7. Low Voltage Power and Control Cable	Okonite	Hypalon Jacket	QUALIFIED
8. Instrumentation Cable	Cerro/Rockblestos	Hypalon Jacket	QUALIFIED
9. Instrumentation Cable	S. Moore Co.	Hypalon Jacket	QT
10. Instrumentation Cable	Raychem	Flamtrol Jacket	QT
11. Level Transmitter	Rosemont	1152	QT,A,M,H
12. Pressure Transmitter	Rosemont	1152	QT,A,M,H
13. Flow Transmitter <sup>(2)</sup>	Hays	T-00252A	INCOMPLETE
14. Thermocouple <sup>(2)</sup>	Weed	E4B	INCOMPLETE
15. RTD <sup>(2)</sup>	Weed	611	INCOMPLETE

## BOP EQUIPMENT (continued)

Equipment Description	Manufacturer	Model	Deficiency
16. Flow & Temperature <sup>(2)</sup> Controller	Love	54-8115-8134- 8174	INCOMPLETE
17. Flow Switch Relay <sup>(2)</sup>	Love	56-8115-8174	INCOMPLETE
18. Control Panel <sup>(2)</sup>	Systems Control	Custom	INCOMPLETE
19. H <sub>2</sub> O <sub>2</sub> Analyzer Panel <sup>(2)</sup>	Delphi	K-IV	INCOMPLETE
20. Power Supply Panel <sup>(1)</sup>	Systems Control	Custom	INCOMPLETE
21. Fan Motor	Westinghouse	TEFC, 182T, 286T	QT
22. Valve Actuator <sup>(1)</sup>	ITT	NH91	FAILED
23. Fan Motor <sup>(3)</sup>	Reliance	TEAD, 184T, 256T 284T	INCOMPLETE
24. Electric Heating Coil <sup>(1)</sup>	CVI	--	INCOMPLETE
25. Pump Motor	Reliance	Horiz., DP, NEMA 184T	QT
26. Recombiner <sup>(1)</sup>	AI	N116000024-03	INCOMPLETE
27. Solenoid Valve	ASCO	HVA-206-832- 3F(2F)	QT, M
28. Solenoid Valve	ASCO	WPHV-206-381- 3F	QT, M
29. Solenoid Valve	ASCO	NP-206-380-7G	QT, M

## BOP EQUIPMENT (continued)

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Deficiency</u>
30. Solenoid Valve	ASCO	NP-206-380-3F	QT,M
31. Solenoid Valve	Valcor	V526	QUALIFIED
32. Limit Switch <sup>(1)</sup>	GPE Controls	LICON65-430140	QT,M,A,R,P
33. Limit Switch <sup>(4)</sup>	Namco	EA-180	INCOMPLETE
34. Valve Motor Operator <sup>(2)</sup>	Limatorque	SMB-000	QT
35. Valve Motor Operator <sup>(2)</sup>	Limatorque	SMB-00	QT
36. Valve Motor Operator <sup>(2)</sup>	Limatorque	SMB-0	QT
37. Valve Motor Operator <sup>(2)</sup>	Limatorque	SMB-1	QT
38. Valve Motor Operator <sup>(2)</sup>	Limatorque	SMB-3	QT
39. Valve Motor Operator <sup>(2)</sup>	Limatorque	SMB-4	QT
40. Radiation Detector <sup>(1)</sup>	General Atomics	RD23	INCOMPLETE
41. Control Switch <sup>(1)</sup>	General Electric	SBM	INCOMPLETE
42. Temperature Switch	United Electric	C302P-103	QUALIFIED
43. Control Switch <sup>(2)</sup>	General Electric	CR 2940	INCOMPLETE
44. Limit Switch	NAMCO	EA700-50100	QUALIFIED

BOP EQUIPMENT (continued)

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Deficiency</u>
45. Electrical Penetration <sup>(2)</sup>	Amphenol	Custom	A,QT,M
<p>(1) Licensee reports that qualification test will be performed on this equipment.</p> <p>(2) Licensee reports that environmental qualification or evaluation not completed.</p> <p>(3) Insufficient information in submittal.</p> <p>(4) Testing on connectors has not been completed.</p>			

# NSSS EQUIPMENT

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Deficiency</u>
(TABLE M.5.2)			
1. Safety Relief Valve <sup>(2)</sup>	Crosby	HB-65-BP	M,A
2. Limit Switch	NAMCO	EA740	A
3. Pressure Switch	Barksdale	BIT	A,R
4. Pressure Switch	STATIC-O-RING	12N	A,R,QT
5. Level Indicator Switch	BARTON	288A	A,R
6. Level Initiating Switch	YARWAY	4418C	A,R
7. Level Indicating Transmitter Switch	BARTON	760	A,R,M
8. Level Transmitter	ROSEMONT	1151	A,R,QT
9. Pressure Transmitter	BAILEY	556	A,R,P,H,
10. Solenoid Valve <sup>(1)</sup>	ASCO	HT832322	INCOMPLETE
11. Level Switch	Magnetrol	751	A,R,P,H
12. Pump Motor <sup>(1)</sup>	GE	324AN	INCOMPLETE
13. Control Valve <sup>(1)</sup>	CONAX	P/N 1832-159-01	INCOMPLETE
14. Voltage Preamplifier	GE	N/S	A,R,P,QT
15. Detector <sup>(2)</sup>	GE	N/A	INCOMPLETE



NSSS EQUIPMENT (continued)

Equipment Description	Manufacturer	Model	Deficiency
16. Pressure Transmitter	ROSEMONT	1151	A,R,QT,M,P,H
17. Insulated Detector	GE	NA05	A,R,QT,P,H
18. Sensor and Converter	GE	--	A,R
19. Pressure Switch	STATIC-O-RING	5N,6N	A,R
20. Power Range Detector <sup>(2)</sup>	GE	NA 200	INCOMPLETE
21. Diff. Press. Indicating Switch	BARTON	288	A,R,QT,M
22. Flow Switch	BARTON	289	A,R,QT,M
23. Pressure Indicator Swtich	ROBERT SHAW	SP 222E	A,R,QT,T,M
24. Pressure Switch	Barksdale	PIH	A,R,M
25. Temperature Element <sup>(3)</sup>	PYCO	300 Series SS	INCOMPLETE
26. Solenoid Valve <sup>(1)</sup>	ITT Hammel-F. H.	502	INCOMPLETE
27. Temperature Element	PYCO	N/A	A,P,H
28. Guide Tube Valve Assembly	GE	N/A	A,R,H,T,QT
29. Hydraulic Control Unit <sup>(1)</sup>	GE	761E500	INCOMPLETE
30. Temperature Element <sup>(3)</sup>	WEED	300 Series	INCOMPLETE
31. Flow Transmitter	S&K	91X-16-4-20	A,R,QT,M,H

NSSS EQUIPMENT (continued)

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Deficiency</u>
32. Steam Turbine	Terry Corp.	GS-2	A,M
33. Pressure Switch	Barksdale	D2H	A,M,QT,R
34. Diff. Pressure Indicator(3)	BARTON	227	INCOMPLETE
35. Temperature Element(3)	CalAlloy/Pyco	N/S	INCOMPLETE
36. Diff. Pressure Transmitter(3)	Statham	PD 2000	INCOMPLETE
37. Temperature Swtich(3)	WEED	22810	INCOMPLETE
38. Temperature Indicator(3)	WEED	4900-S-4	INCOMPLETE
39. Flow Transmitter	Rosemont	1152	A,R,QT
40. Level Transmitter	Gould Inc.	PD3018	A,M
41. Dry Tube(3)	GE	N/S	INCOMPLETE
42. Flange(3)	GE	N/S	INCOMPLETE
43. Condensing Chamber(3)	GE	N/S	INCOMPLETE
44. Diff. Pressure Indicating Switch	BARTON	288	A,R,QT,M
45. Temperature Element(3)	Rosemont	N/A	INCOMPLETE
46. Drywell Penetration Flange(3)	GE	N/S	INCOMPLETE
47. Guide Tube(3)	Handy & Harmon	N/S	INCOMPLETE
48. Check Valve(3)	Matheson Co. Inc.	N/S	INCOMPLETE

NSSS EQUIPMENT (continued)

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Deficiency</u>
49. Pressure Indicator <sup>(3)</sup>	Robert Shaw	613B	INCOMPLETE
50. MO Gate Valve <sup>(3)</sup>	Limatorque	SMB-2-25 SMB-3-60	INCOMPLETE

(1) Equipment which the licensee has identified as requiring additional evaluation or qualification documentation.

(2) Equipment located in reactor vessel.

(3) Equipment which may not fall within NUREG 0588 requirements.

MISC. BOP & NSSS FROM TABLES 5.4 & 5.5

<u>Equipment Description</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Deficiency</u>
(TABLE 5.4)			
3. Vacuum Switch	Barksdale	DIT-H1855	QT,M,A,R,H
(Table 5.6)			
16. Pressure Indicator Switch <sup>(1)</sup>	Robert Shaw	SP-222E	INCOMPLETE
19. Pressure Transmitter <sup>(1)</sup>	Bailey	556	INCOMPLETE
20. Flow Transmitter <sup>(1)</sup>	Rosemont	1151	INCOMPLETE
21. Level Transmitter <sup>(1)</sup>	Barton	352/368	INCOMPLETE
43. Heater Assembly	GE	47B518673	P,H,A
44. Leakage Control Blower	Siemens	2CH6	T,P,M,A
45. Pump Motor	Ingersoll Rand	5K6339XC109A	P,M
46. Pump Motor	Ingersoll Rand	5K6347XC59A	P,M
47. Pump Motor	Ingersoll Rand	5K6357XC8B	P,M
48. M.O. Valve	Limitorque	SMB-00-25	QT,A
49. M.O. Valve	Limitorque	SMB-4-200	QT,A,R
50. M.O. Valve	Limitorque	SMB-3-100	QT,A,R
51. M.O. Valve	Limitorque	SMB-3-80	QT,A,R
52. M.O. Valve	Limitorque	SB-0-25	QT,A

MISC. BOP & NSSS FROM TABLES 5.4 & 5.5 (continued)

53. M.O. Valve	Limiterque	SMB-2-60	QT,A
54. M.O. Valve	Limiterque	SMB-4-150	QT,A

(1) Qualification under NUREG 0588 may not be required.

## APPENDIX B

### SUMMARIES OF LSCS CENTRAL FILE REVIEWS

Item: Bailey Pressure Transmitter (Model 556)

The Bailey pressure transmitter is used to provide the reactor vessel pressure signal for the post accident monitoring recorder. The transmitter is located within the reactor building in zone RB2. Bounding environmental qualification parameters are identified as temperature (145°F for one day then 134°F to 100 days), pressure (atmospheric), relative humidity (95%), and radiation ( $1.8 \times 10^5$  Rads TID). The required operating time within an adverse environment is up to 100 days.

The audit of the environmental qualification documentation indicated that this type of unit was exposed to a temperature of 212°F for six hours. Qualification for temperature, humidity, and radiation, as well as the requirement for aging, for the required 100 day operability were by analysis only. Qualification time, humidity, radiation, and aging remain as concerns resulting from the audit.

Item: Yarway Level Indicating Switch (Model 4418C)

The Yarway level indicating switch is used to sense reactor water level to trip the recirculation pump. The switch is located within the reactor building in zone RB2. Bounding environmental qualification parameters are identified as temperature (145°F), pressure (atmospheric), relative humidity (95%), and radiation ( $1.8 \times 10^5$  Rads TID). The required operating time within an adverse environment is 45 sec.

Of major concern is the fact that the test report for this item was not in the central files. The audit was therefore done on the summary sheet, some documentation present in the file, and the qualification environment presented in the submittal. The item appears to be qualified for



temperature and humidity. Qualification for aging and radiation was by analysis only.

Item: 5kV Power Cable--Kerite Co.

The 5kV Kerite power cable is used throughout the plant (except containment). The most severe environment is in the reactor building. The abnormal environment is defined as Zone H5. The limiting environmental parameters in this zone are identified as temperature (0-6 hr at 212°F), (6-12 hr at 150°F), and (12 hr-100 days at 150°F); pressure (0-6 hr at 7" H<sub>2</sub>O), (6-12 hr at 7" H<sub>2</sub>O), and (12 hr-100 days at atmospheric); relative humidity (0-6 hr at steam), (6-12 hr at 100%), and (12 hr-100 days at 90%); radiation ( $8.93 \times 10^6$  Rad); operability requirements (100 days).

The audit of the referenced qualification documentation confirmed that this item was exposed to compatible environmental conditions to those indicated above. Qualification method was by prototype test and analysis. Margin for time remains a concern as results from the audit. Justification for this concern will be reflected in a future submittal and the test report will be updated to show the time margin requirement.

Item: Instrumentation Cable--Samual Moore Company

This instrumentation cable is used throughout the plant with the containment being the harshest environment. The limiting environmental parameters are identified as temperature (3 hours at 340°F, 3 hours at 320°F, 18 hours at 250°F, 99 days at 200°F), pressure (-2 to 45 psig for 6 hours, 0-25 psig for 18 hours, 0-20 psig for 99 days), radiation ( $4.4 \times 10^7$  Rads TID), and relative humidity (steam/100%). The operability requirement is 100 days.

The audit of the environmental qualification documentation confirmed that this item was exposed to compatible environmental conditions to those indicated above, with slight deviation in pressure. The test included pre-aging and electrical energization under test. No margin is demonstrated for operability requirement time or for temperature, and no justification

is shown for lack of margin. These margins remain a concern and justification will be provided in the next submittal.

Item: Gould Inc. Level Transmitter (Model PD 3018)

The Gould level transmitter is used to measure the scram discharge volume water level and signals the RPS to scram the reactor when the level is too high. The transmitter is located within the reactor building in zone RB1. Bounding environmental qualification parameters are identified as temperature (145°F), pressure (atmospheric), relative humidity (95%), and radiation ( $1.8 \times 10^5$  Rads TID). The required operating time within an adverse environment is one hour.

The audit of the environmental qualification documentation confirmed that this type of unit was exposed to environmental conditions which exceeded those listed above by adequate margin; i.e. temperature (220°F), pressure (atmospheric), relative humidity (steam), radiation ( $2.0 \times 10^7$  Rads TID) and time (three hours). The requirement for aging, however, was by analysis only. The audit indicates that this item is qualified per NUREG 0588 Category II with the exception of aging.