

U. S. NUCLEAR REGULATORY COMMISSION  
OFFICE OF INSPECTION AND ENFORCEMENT

REGION III

Report No. 50-373/78-34

Docket No. 50-373

License No. CPPR-99

Licensee: Commonwealth Edison Company  
P.O. Box 767  
Chicago, IL 60690

Facility Name: La Salle County Station, Unit 1

Inspection At: Seneca, IL

Inspection Conducted: December 26-27, 1978

Inspectors: E. J. Gallagher

*E. J. Gallagher* 1/18/79

W. A. Hansen (December 27 only)

*W. A. Hansen* 1/18/79

Approved by: *F. J. Jablonski for*  
R. L. Spessard, Chief  
Engineering Support Section 1

1/18/79

Inspection Summary

Inspection on December 26-27, 1978 (Report No. 50-373/78-34)

Areas Inspected: Unit 1 Containment Structural Integrity Test including program and procedures, observation of test and review of test records and followup on previously identified unresolved items and items of noncompliance. The inspection involved a total of 17 inspector-hours onsite by two NRC inspectors.

Results: Three areas were inspected. No items of noncompliance or deviations were identified.

7903070049

## DETAILS

### Licensee Personnel

- \*L. J. Burke, Site Project Superintendent
- \*G. E. Groth, Start-up Engineer
- \*J. R. Kodrick, QA Coordinator

### Other Personnel

- C. N. Krishnaswany, Sargent and Lundy Design Engineer
- R. Cheboub, Sargent and Lundy Design Engineer
- J. Lai, Sargent and Lundy Design Engineer
- B. Henley, Sargent and Lundy
- R. Krause, Wiss, Janney, Elstner and Associates
- P. Lineham, Wiss, Janney, Elstner and Associates
- B. Paradise, Wiss, Janney, Elstner and Associates
- L. Estenssoro, Wiss, Janney, Elstner and Associates
- D. Jones, General Electric, Start-up Engineer
- \*M. Dougherty, Walsh Construction

\*Denotes those in attendance at exit interview.

### Licensee Action on Previous Inspection Findings

(Closed) Noncompliance (373-78-08-07; 374/78-07-07) - Failure to translate three FSAR commitments into the construction specification and procedures for the containment post-tensioning.

- a. FSAR, Section 3.8.1.1.3.3 required friction tests to be performed on typical tendons of the containment structure while the construction procedure did not include this work activity. The inspector reviewed Engineering Change Notice (ECN) 1024 issued April 10, 1978 which include the provision to perform friction tests on horizontal tendons. Friction tests have been performed on three horizontal tendons of Unit 1.
- b. FSAR, Section 3.8.1.1.3.3 and Spec. J-2535, Section 13-211.4(b) required tendon elongations that exceed  $\pm 5\%$  of calculated elongations to be investigated and corrected. INRYCO Prestressing Manual Chapter 5.4(j) permitted  $\pm 10\%$ . The inspector reviewed FSAR Amendment 31 and ECN 1024 which revised Spec. J-2535 to be consistent with the INRYCO Field Manual i.e. permitting an allowable of  $\pm 10\%$  of calculated elongations.
- c. FSAR, Appendix E, Section E.3.1 required erection fabrication and testing requirements for the prestressing system to conform to ASME B&PV code Section III, Division 2 articles CC-2000, 4000 and 5000. Sargent and Lundy Spec. J-2535 did not include these

requirements in the code. FSAR Amendment 31 was issued April 1978 to specify the particular sections of CC-2400, 4400, and 5400 which exceptions have been taken. These exceptions will be part of the licensing review.

Satisfactory corrective action has been taken on the above items. This item is considered closed.

(Closed) Unresolved (373/78-09-04; 374/78-08-04) - Review of concrete quality production records between April 1977 and September 1977 and quality control chart for December 1977 indicated a decline in the compressive strength and an increase in the coefficient of variation. Reason for the above was not known at the time of the inspection. The licensee researched the concrete records and indicated to the inspector that the cause of the reduction in strength was due to a reduction in cement content during that time. The reason for the higher coefficient of variation was due to the inclusion of erroneous cylinder breaks caused by damaged cylinders or cylinders that had been improperly cured. These values have been disregarded and revised coefficients of variation calculated which indicate acceptable results. This item is considered closed.

#### Functional or Program Areas Inspected

##### Containment Structural Integrity Test (Unit 1)

The inspector performed a procedure review, witnessed test performance, and reviewed test results to ascertain whether the La Salle Unit 1 Containment Structural Integrity Test (SIT) was performed consistent with the regulatory requirements (Regulatory Guide 1.18, ASME B&PV Code, Section III, Division 2 and FSAR commitments).

The La Salle County Station is the first of the BWR Mark II type containments to have the SIT performed, and therefore, it is regarded as a prototype containment.

#### 1. Review of Program and Test Procedures

- a. FSAR and Code Commitments - the LSCS-FSAR Section 3.8.1.7.2.1 requires that the containment structure be instrumented for strain and deflection measurements in accordance with the ASME B&PV Code, Section III, Division 2, Article CC-6000. In addition to the above, FSAR, Appendix B commits to compliance with Regulatory Guide 1.18 (Structural Acceptance Test for Concrete Primary Reactor Containments).
- b. Test Procedure - The inspector reviewed CECO construction test procedure entitled, Structural Integrity Test, Revision 0, dated December 8, 1978, which had been reviewed and approved

for use by licensee authorized personnel on December 14, 1978. The test procedure references ASME B&PV Code Section III, Division 2, Article CC-6000 and Regulatory Guide 1.18 as applicable. The test procedure contained the following items which are requirements of either the code or regulatory guide:

1. Maximum rate of pressurization/depressurization of the containment is specified as 10 psi per hour (reference: Test Procedure Item 7c)
2. Surface crack patterns were required to be recorded in seven areas of approximately 40 square feet each at atmospheric pressure before the test, at each incremental increase in pressure up to and including maximum test pressure and at atmospheric pressure after the test (reference: Test Procedure Item 10.1A; FSAR Section 3.8.1.7.2.1 and Figure 3.8-32 and Regulatory Guide 1.18, Item 1; Code CC-6233).
3. At four specified equal increments of pressure (0, 13, 26, 39, and 52 psi) constant pressure was required to be maintained for at least one hour for recording strain and deflection measurements (reference: Test Procedure Item 10.1A; Regulatory Guide 1.18 Item 5; Code CC-6232 and 6234).
4. The maximum test pressure was specified to be 1.15 times design pressure, or 52 psi with a specified tolerance of +1, -0 psi (reference: Test Procedure Item 10.1A; Regulatory Guide 1.18 Item 1).
5. The test procedure required approval from a CECO station construction engineer and a Sargent and Lundy engineer prior to each incremental pressure increase.
6. In Attachment A to the test procedure, the type and location of each instrument was documented (reference: FSAR, Figure 3.8-31)

No items of noncompliance were identified.

2. Observation of Containment Structural Integrity Test (Unit 1)

The inspector witnessed portions of the SIT during the inspection in order to ascertain whether activities associated with the SIT were technically adequate and met the requirements of the procedures.

- a. Pressure Gauges: the inspector observed pressure gauge No. 36 located at elevation 807 and gauge No. 35 located at elevation 740. Licensee personnel continually monitored the containment pressure by visual observation of these gauges during the test.

- b. Strain Gauges: all of the Carlson type strain gauges are embedded in the concrete basemat or containment wall, and are therefore not observable. Two surface mounted A9 strain gauges were observed, and were located in the proper area. The surface mounted gauges were six inches long while the Carlson type gauges are ten inches long.
- c. Deflection Meters: the extensimeters being used to measure containment displacements were located inside the drywell, and therefore were not observable during the test. The inspector did observe a prototype of the deflection meters which are manufactured by Wiss, Janney and Elstner and Associates.
- d. Rate of Pressurization: the inspector observed that the rate of pressurization was within the maximum permitted of 10 psi per hour. The compressors being used were capable of pressurizing the containment on the order of 5 psi per hour. Pressurization began at approximately 11:00 a.m. on December 26, 1978.
- e. Increments of Pressure Increase: the required increments of pressure were followed: i.e., 13, 26, 39, 52 psi and depressurization in the same reverse order. Specified holding time of one hour between increments was also maintained.
- f. Performance of CSIT Crew: the test crew was made up of CECO station construction personnel (coordination, checkpoints and monitoring pressure gauges), Wiss, Janney and Elstner personnel (providing the instrumentation and data acquisition) and Sargent and Lundy Engineers (coordinating, approvals and review of data during the test). The test crew was well coordinated and was familiar with the procedure and application of reviewing the instrumentation and data.
- g. Final Test Pressure: maximum test pressure was achieved at approximately 11:30 p.m. on December 26, 1978 at a pressure of 52.7 psi. Pressure was held for the specified length of time (one hour) while data recordings were made, including strains, deflections and crack patterns in the seven areas.
- h. Rate of Depressurization: the inspector observed the rate of depressurization as required, i.e., 52, 39, 26, 13, and 0 psi.
- i. Environmental Conditions: the containment is a BWR Mark II located inside the reactor building enclosure, and therefore not subjected to any extreme environmental conditions, such as high wind, snow, or temperature differentials. Temperature was being monitored inside the drywell from the control room. Minimum temperature permitted was 70°F (FSAR Section 3.8.1.7.2.1). Actual temperature was recorded to be on the order of 80° to 90°F. Temperature was

also being monitored inside the concrete at the Carlson strain gauge locations. Temperature at these areas were on the order of 65°F. No extreme changes of temperature or pressure were recorded during the test.

- j. Crack Mapping: as indicated in FSAR Figure 3.8-32, seven areas were prepared to monitor cracks. These areas included: at the junction of the basemat - containment wall; in the cylinder portion of the wall; at the junction of the cone - cylinder; near the equipment hatch; and at the mid-section of the cone portion of the wall. The inspector observed all of the seven areas and witnessed the identification and measurement of selected crack patterns at different pressures.
- k. Deflection and Strain Measurements: measurements were observed to be taken at the specified pressures after the required 1 hour holding time.
- l. Radial and Vertical Deflections: deflections measured at the required intervals of pressurization and depressurization.
- m. Radial and Tangential Deflection: deflections were recorded around the largest opening (equipment hatch) at the specified interval.
- n. Repairs: no repairs were anticipated to be required after the completion of the tests.

No items of noncompliance were identified.

3. Results of Containment SIT (Unit 1)

The containment is considered to have satisfied the structural acceptance test if the following requirements have been met according to FSAR Section 3.8.1.7.2.1 and the code CC-6213:

- a. yielding of reinforcement does not develop;
- b. no visible signs of permanent damage to either the concrete structure or steel liner;
- c. the deflection recovery 24 hours after complete depressurization is 80% or more; and
- d. the measured maximum deflection at points of maximum predicted deflection does not exceed the predicted values by more than 30%. This requirement is waived if 24 hour recovery is greater than 90%.

On December 29, 1978 a licensee test engineer telephoned to inform the NRC Region III office that the containment structural integrity test was complete and that the above four criteria had been satisfied

for the Unit 1 La Salle containment. The final report of the test is to be submitted to the NRC in accordance with Regulatory Guide 1.18, item 13 which delineates the information to be included in the final test report. The final test report will be reviewed, and the results of this review will be documented in an IE inspection report.

4. Review of SIT Records (Unit 1)

The inspector reviewed selected SIT records that were available before the test and also being generated during the test. The following specific items were reviewed:

a. Test Instrumentation Calibration

- (1) Pressure Gauges - two gauges were used to monitor containment pressure (HIL # 35 and 36). The ASME code Section III, Div. 2, article CC-6238.1 requires that the gauge be graduated to "not less than 1 1/2 times the test pressure nor more than 4 times that pressure" [i.e.,  $1.5 \times 52 \text{ psi (test pressure)} = 78 \text{ psi}$ ]. The gauges were graduated to 60 psi; however, the calibration records for both gauges indicated an accuracy of  $\pm 0.4\%$  ( $\pm 0.2 \text{ psi}$ ) at full range of 60 psi. The gauges are also required to be calibrated after the test to assure their accuracy during the test. SIT procedure section 5.7 requires the above. The inspector has no further questions on this matter at this time.
- (2) Strain Gauges (Carlson type) - documentation for the calibration of the following strain gauges were reviewed and found satisfactory:

<u>Gauge Nos.</u>	<u>Calibrated</u>
A962	October 16, 1974
A1148	March 24, 1975
A1133	March 24, 1975
A1153	March 24, 1975
A955	October 16, 1974
C5	July 21, 1975
A1007	October 25, 1974
A1271	August 22, 1975

The 10" Carlson strain gauges were installed prior to concrete placement in the basemat and containment wall according to the detail shown on S&L drawing S-344, Rev. F.

- (3) Deflection Meters (Extensimeters) - Wiss, Janney, Elstner and Associates, manufacturers, inspected and tested the following deflection meters and certified that they were calibrated to NBS standards:

<u>Meter Nos.</u>	<u>Calibrated</u>
1178	December 14, 1978
1200	December 16, 1978
848	December 21, 1978
1018	December 21, 1978

b. Review of Data Acquisition During the SIT

The inspector reviewed raw data that was being compiled during the SIT for strains, stresses and deflections at selected points of the containment monitoring program and compared the recorded values with the predicted values in the FSAR, table 3.8.5. Sargent & Lundy personnel indicated that discrepancies between recorded and predicted values would be explained in the final report submitted for the SIT. The following tables for strain, stress and deflection data were recorded during the inspection with a comparison to predicted values from the FSAR. According to the Sargent & Lundy design engineer, the data compiled indicated the strains and displacements to be linear as expected.

		<u>STRAIN (x 10<sup>-4</sup> in/in)</u>	
<u>Location</u>	<u>Meter No.</u>	<u>Recorded @ 52 psi</u>	<u>Predicted in FSAR @ 52 psi</u>
Basemat	BS1	+ 0.23	- 0.607
Basemat	BS2	+ 0.07	- 0.129
Basemat	BS3	- 0.03	+ 0.183
Containment Wall	CW6	- 0.03	+ 1.157
Containment Wall	CW7	- 0.06	- 0.052
Containment Wall	CW9	- 0.03	+ 0.682
Buttress	BT-39	+ 0.17	+ 0.925
Buttress	BT-40	+ 0.27	+ 0.249
Equipment Hatch	EQ-51	- 0.21	+ 1.377
Equipment Hatch	EQ-52	- 0.11	+ 0.743
Equipment Hatch	EQ-53	0	+ 1.305

		<u>DISPLACEMENTS (inches)</u>	
<u>Location</u>	<u>Meter No.</u>	<u>Recorded @ 52 psi</u>	<u>Predicted in FSAR @ 52 psi</u>
Above drywell floor	V7	+ 0.08	+ 0.187
Suppression Pool	D1	+ 0.023	+ 0.047
Suppression Pool	D7	+ 0.031	+ 0.081
Above drywell floor	D15	+ 0.015	+ 0.020
Top of Containment	D25	+ 0.009	+ 0.025



<u>Location</u>	<u>Meter No.</u>	<u>STRESS (Psi)</u>	
		<u>Recorded @ 52 psi</u>	<u>Predicted in FSAR @ 52 psi</u>
Containment wall	CW14	185	280
Drywell floor slab	DF17	out-of-order	---
Intersection Cone- Cylinder	CW24	out-of-order	---
Containment wall (Cone)	CW29	181	162

NOTE: ASME B&PV Code CC-6241 and Reg. Guide 1.18 section 12 require predicted values to be established prior to the test.

c. Pretest of Instrumentation

The Code CC-6242 and test procedure item 5.7(H) require that readings from all strain measuring devices be recorded daily for a period of one week prior to the commencement of the test. The inspector observed the records indicating that strain measurements were taken from December 19 to December 26, 1978.

No items of noncompliance were identified.

7. Exit Interview

The inspectors met with licensee representatives on December 27, 1978 to summarize the scope and findings of the inspection. The licensee acknowledged the findings as reported.