

U. S. ATOMIC ENERGY COMMISSION
REGION I
DIVISION OF COMPLIANCE

Co Report No. 289/70-4

Licensee: Metropolitan Edison Company (Met-Ed)
(Three Mile Island Unit No. 1)
License No. CPPR-40

Date of Inspection: May 26 - 28, 1970

Date of Previous Inspection: May 11 and 12, 1970

Inspected By: D. M. Hunnicutt 7/24/70
D. M. Hunnicutt, Reactor Inspector (Principal) Date

A. A. Varela 7/24/70
A. A. Varela, Reactor Inspector Date

Reviewed By: E. M. Howard 7-24-70
E. M. Howard, Senior Reactor Inspector Date

Proprietary Information: None

SCOPE

A routine, announced inspection was made of Unit No. 1, one of the two 2535 MWt pressurized water reactors (B&W) under construction on Three Mile Island near Middletown, Pennsylvania. The inspection effort was directed toward an appraisal of the performance of the licensee - contractor effort of various items listed in PI 3800/2 and included an inspection of Attachment C - Containment, Concrete (4600) and Welding (4800), the status of outstanding items previously reported and a detailed history of safe ends for all primary system components.

Concrete inspection was performed by Varela and Hunnicutt inspected outstanding items and a partial review of welding.

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SUMMARY

Unit No. 1 is 40 per cent complete, based on manhours expended.

Primary system components are scheduled for delivery prior to September 1, 1970. One steam generator has arrived at the construction site. Storage facilities and procedures for handling the components are not available.

Routine inspection of various items listed in PI 3800/2 (4800) indicated that acceptable practices are being used and no deficiencies were found.

A detailed safe end status for all primary system major components is discussed. Met-Ed is satisfied with the B&W procedures and fabrication concerning the safe ends.

Seven outstanding items from previous inspections were identified. Two items were resolved, the remaining five items will be carried on the outstanding item list and attempts to resolve these items will be made during future inspections.

Met-Ed is studying methods to verify the accuracy of cable runs, equipment and terminations.

Safety Items

None

Nonconformance Items

1. Concrete trial mixes were not prepared in accordance with ACI 301-66 as required by QC No. 1 and paragraph 5.2.2.1, Volume 2, of the Final Safety Analysis Report. (See Section L)
 - a. Cement used for Unit No. 1 reactor building was Allentown, Type II. Trial mixes were prepared using Medusa, Type II brand of cement. Trial mix report ER-70-6, dated February 5, 1970, states that any change in cement brand would necessitate concrete design changes.
 - b. ACI-301, Method 2 of Section 308, which is invoked in Quality Control Procedure No. 1 for mix designs specifies that for each water-cement ratio at least three specimens for each age to be tested shall be prepared and specimens shall be made, cured and tested for each age. Report of Trial Mixes No. ER-70-6 states that five cylinders of each test batch were cast for tests of compressive strength at seven and twenty-eight days; however, only two test cylinder results are given in the report for the twenty-eight day test.

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- c. ACI-301 states that trial mixes shall be prepared using at least three different water-cement ratios from which a curve was to be plotted showing the relationship between water-cement ratio and compressive strength. This information was not available for review.
2. The batching plant did not follow the sequence of admixture addition, recommended by the manufacturer of the admixtures, as required by ACI-301-66. Paragraph 5.2.2.1, Volume 2 of the Final Safety Analysis Report states: "Structural concrete work has been performed in accordance with ACI-301-66, modified as necessary for the more exacting requirements of the reactor building."

Unusual Occurrences

None

Other Significant Items

Concrete production was halted on May 26, 1970, pending results of an investigation of the mix presently being used. There has been a continual decline in concrete strength of the 5000 psi concrete. Four out of eleven test cylinders for concrete placed on March 25, 1970, were less than the specified 5000 psi value.

Status of Previously Reported Problems

1. Status of replacement pipe for pipe rejected due to incomplete fusion or the addition of filler metal. This item is considered resolved. (See Section J.1)
2. Results of radiographic interpretation for Grinnel Corporation pipe following repairs. This item remains open. (See Section J.2)
3. Status of 10 inch or larger diameter valves suspected of possible furnace sensitization. This item is considered resolved. (See Section J.3)
4. Status of 4 inch valves from Alloyco. Three valves were reported to have been cracked when received by Met-Ed. This item remains open. (See Section J.4)
5. Status of welds improperly marked by using high stress stamp. This item remains open. (See Section J.5)
6. Deficiencies on two PDM bleed tanks due to unacceptable welder qualification records. This item remains open. (See Section J.6)

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- 7. CB&I has not supplied copies of the NDT procedure qualification documents to Met-Ed, to date. This item remains open. (See Section J.7)

Management Interview

An exit interview was held with Messrs. Hreczuch, Shepard and Sfuebner. The inspector stated that the storage preparations for the primary system components appear to be nonexistent and that adequate handling procedures had not been prepared. Mr. Shepard stated that the primary system components would be sheltered, as necessary, to assure adequate protection until the components were installed or at least stored in the containment vessel. Mr. Shepard said that procedures are being prepared and would be available prior to unloading or otherwise handling the components.

The inspector asked if Met-Ed concurred with the safe end preparations for the reactor vessel and the other primary system components. Mr. Shepard stated that Met-Ed was satisfied with the B&W fabrication procedures and the proposed methods of safe preparation.

The inspector stated that the plant records for the containment liner, piping and general welding were satisfactory.

The status of previously reported problems was discussed. Mr Hreczuch stated that all known problem areas were being actively pursued and that satisfactory resolution of each outstanding problem would be achieved at the earliest date possible.

The inspector stated that the review of the records and procedures for concrete indicated that the licensee had deviated from the FSAR in that the provisions of ACI-301-66 were not being strictly followed, specifically in the area of design mixes.

Hreczuch stated that this would be examined. In answer to a previous question by Hreczuch concerning the applicability of the questions asked by the inspector during the progress of the inspection to other facilities, the inspector stated that his inspection effort was in consonance with the Division of Compliance inspection program for reactors under construction and this program was uniformly applied.

DETAILS

A. Persons Contacted

Met-Ed

- Mr. George Bierman, Project Manager
- Mr. Gene Hreczuch, Construction Engineer
- Mr. Vern Stuebner, Resident Engineer, Electrical
- Mr. Will Shepard, Resident Engineer, Mechanical and Civil
- Mr. Earl Allen, Resident QA Engineer

UE&C

- Mr. J. E. Fant, Site QC Manager
- Mr. H. A. Hardy, Assistant QC Supervisor

B. Construction Status

Mr. Shepard estimated that Unit No. 1 was 40 percent complete. This estimate was based on manhours expended.

C. Reactor Vessel

1. Met-Ed has been informed that the B&W fabricated reactor vessel for Unit No. 1 is scheduled for delivery to the construction site about July 15, 1970. Mr. Shepard stated that this delivery is earlier than desired and that Met-Ed will be hard pressed to prepare for delivery of the reactor vessel. The unloading, preparation for installation and installation procedure for the reactor vessel has not been completed. Mr. Shepard stated that the procedure would be prepared and approved prior to unloading the reactor vessel.
2. Storage facilities for the reactor vessel are non-existent. Mr. Shepard stated that adequate protection for the reactor vessel would be prepared. The inspector indicated that site storage of the reactor vessel should assure adequate protection from damage by weather, chemical contaminants, personnel and equipment.
3. The reactor vessel safe end status is included in a letter from Mr. E. G. Ward, B&W, to Mr. G. Bierman, Met-Ed, dated April 6, 1970. This letter states the following:
 - a. Core Flooding Nozzles - These nozzles will be buttered with inconel prior to stress relief of the reactor vessel. After stress relief, stainless steel safe ends

will be welded onto the vessel.

- b. Internal Flow Stabilizers - same procedure as for the Core Flooding Nozzles.
- c. Inconel Core Catch Lugs - These lugs will not be welded to stainless steel cladding, but instead to inconel cladding and/or to the reactor vessel base metal.

D. Steam Generators for Unit No. 1

- 1. SG No. 1 (East) was fabricated by B&W and arrived at the Three Mile Island construction site on May 25, 1970 by special railroad car. The SG was visually inspected externally. No apparent damage was observed. The inspector observed the internal visual inspection, which included checks for damage, broken desiccant bags and that the desiccant indicated that little moisture had been absorbed by it. The SG was resealed and a nitrogen purge of about 1/2 inch water pressure was initiated. Mr. Shepard stated that the nitrogen purge would be continuous until the SG was installed in the containment vessel. Installation is currently estimated for October, 1970.
- 2. SG No. 2 (West) is being fabricated by B&W and is scheduled to arrive at the construction site about September 1, 1970.
- 3. Storage facilities to house either or both of the SGs are nonexistent. Storage under construction is not scheduled for completion until about October, 1970. Mr. Shepard stated that Met-Ed is aware of the lack of storage space. He added that the boilermakers strike* has delayed completion of the containment vessel which was originally designated as storage space for Class I components.

4. Design Change

A letter from Mr. E. G. Ward, B&W, to Mr G. Bierman, Met-Ed, dated April 6, 1970, stated that the only change in the SG is "an inconel nozzle for SG drain connection". Mr. Shepard stated that Met-Ed has not been advised of any other design or fabrication deviations. Inspection of SG No. 1 (east) indicated that there are no other design or fabrication deviations, according to Mr. Shepard.

*CO Report No. 289/69-5, paragraph III.7

5. Procedure

A procedure for unloading, preparation for installation and installation of the SG has not been completed. Mr. Shepard stated that a procedure would be completed and approved prior to unloading the SG from the special rail car.

E. Pressurizer

1. Met-Ed has been informed that the B&W fabricated pressurizer for Unit No. 1 is scheduled for delivery to the construction site about June 23, 1970. A procedure for unloading, preparation for installation and installation of the pressurizer has not been completed. Mr. Shepard stated that a procedure would be prepared and approved prior to unloading the pressurizer.
2. Storage facilities for the pressurizer are non-existent. The inspector stated that storage preparations for the pressurizer should be similar to those available for the reactor vessel.
3. The pressurizer safe end status is included in a letter from Mr. E. G. Ward, B&W, to Mr. G. Bierman, Met-Ed, dated April 6, 1970. This letter states the following:
 - a. All nozzles under 4 inches diameter will have inconel safe ends attached prior to stress relief of the pressurizer.
 - b. The 4 inch spray connection and surge line will have stainless steel thermal sleeves. The thermal sleeves span dissimilar welds. The carbon steel nozzles will be attached prior to stress relief. The 4 inch carbon steel nozzle will have an inconel safe end attached and welded into the pressurizer prior to stress relief. The thermal sleeve for this 4 inch carbon steel nozzle will be installed subsequent to the final stress relief. The 10 inch carbon steel nozzle will be buttered with inconel and welded into the pressurizer prior to stress relief. The stainless steel safe end and the thermal sleeve will be attached subsequent to the final stress relief.
 - c. The stainless steel internals will be installed in the pressurizer subsequent to the final stress relief.

F. Reactor Vessel Internals (RVI)

The RVI are being fabricated by B&W. The delivery schedule indicated that the RVI would be delivered to the construction site about February 1, 1971.

G. Core Flood Tanks (CFT)

1. Mr. Shepard stated that the CFT for Unit No. 1 will be delivered to the construction site during June, 1970. A procedure for handling and storage of the CFT has not been completed.
2. Storage facilities for the CFT have not been prepared. The inspector stated that storage and handling requirements for the CFT should be similar to those available for other Class I components.
3. The CFT safe end status is as follows, according to a letter from Mr. E. G. Ward, B&W, to Mr. G. Bierman, Met-Ed, dated April 6, 1970:
 - a. All nozzles less than 4 inches in diameter will have inconel safe ends.
 - b. The 14 inch diameter carbon steel core flooding nozzle will be buttered with inconel prior to stress relieving. Stainless steel safe ends will be attached subsequent to the final stress relieving operation.

H. Main Coolant Piping (MCP)

1. Mr. Shepard stated that MCP for Unit No. 1 will be delivered to the construction site as fabrication is completed. The present delivery schedule indicates that delivery will commence early in June, 1970 and delivery will be completed about November 1, 1970. A procedure for handling and storage of the MCP has not been completed. The MCP for Unit No. 1 is carbon steel piping clad with stainless steel. An inspection in accordance with Attachment F, PI 3800/2 will be performed on a subsequent inspection.
2. Storage facilities for the MCP have not been prepared. The inspector stated that storage requirements for the MCP should be similar to those available for the other Class I components.
3. The MCP safe end status is included in a letter from Mr. E. G. Ward, B&W, to Mr. G. Bierman, Met-Ed, dated April 1970. The letter states the following:
 - a. Nozzles less than 4 inches in diameter will have inconel safe ends attached prior to stress relief of the piping.
 - b. 10 and 12 inch diameter carbon steel nozzles will be buttered with inconel prior to the final stress relief operation.

- c. Stainless steel safe ends on carbon steel piping adjacent to the MCP internal to work to be performed on the NSSS by B&W will be completed as stated in "b" above.
- d. The high pressure injection nozzles will contain thermal sleeves. These carbon steel sleeves will be buttered with inconel prior to the final stress relief operation. Stainless steel safe ends will be attached subsequent to the final stress relief operation.

I. Containment - Unit No. 1, Welding (4800)

1. Review of Quality Control System 4805.04

a. Qualifications 4805.04.a

(1) Weld Procedures 4805.04a.1

The inspector examined five welding procedures that have been prepared by CB&I and approved for use by United Engineers and Constructors (UE&C). Each of these procedures provided for visual inspection, cleaning, joint preparation, staggering of the start and stop points for multiple passes, a sketch indicating the pass sequence and repairs of unacceptable welding or defects. Each of these five procedures had been qualified in the flat, vertical, horizontal and overhead positions. Charpy notch tests of the weld metal and heat affected zones were in accordance with Section IX of the ASME Code.

(2) Nondestructive Test Techniques 4805.04a.3

The inspector examined quality control procedures that implemented control of field fabrication on the liner. Procedures covering LP and MP examination provided methods and acceptance standards for examination of welds. The radiographic procedure provided information to be used in auditing, inspecting and witnessing the performance of radiographic examinations by UE&C. Methods of evaluating and approving written radiographic examination procedures submitted by sub-contractors and vendors of UE&C is included in the radiographic procedure.

b. Visual Inspection 4805.04c

(1) Welding 4805.04c.1, 2, 3, 4, 5 and 6

welding quality control program for the containment

liner and the river water secondary heat exchangers for nuclear service were reviewed. Visual inspection of welding, verification of work performance and record keeping practices in these areas was performed. Visual inspection of joint preparation, root gap and root pass, alignment prior to root pass and inspection of the completed weld were considered satisfactory and consistent with stated intent of paragraph 5.5.5 of Volume 2 of the FSAR.

c. Nondestructive Testing 4805.04e

(1) Radiograph Quality 4805.04e.1

The inspector selected twenty random films from various portions of the containment liner and checked each film for required information, quality level and general acceptance. All films met the requirements stated in UE&C Quality Assurance Procedure QC-5C, Rev. 1. The commitments made in Volume 2, Section 5.5.5.2 of the FSAR related to radiography were met.

J. Outstanding Items Previously Reported

1. Stainless Steel Pipe*

Plant records indicate that as previously reported, all 2½ and 3 inch pipe, ASTM A-312, suspected of incomplete fusion or the addition of filler metal was rejected for nuclear service. Replacement pipe manufactured to ASTM A-376 has been received at the construction site. Physical, chemical and visual checks indicate that the pipe meets the ASTM and site requirements. Details, specifications and documentation will be reviewed on a subsequent inspection.

2. Stainless Steel Pipe, ASTM A-358, Class I and II by Grinnel Corp.**

Mr. Shepard stated that Met-Ed had two inspectors at the Grinnel Corporation manufacturing plant during the time the inspectors were conducting this inspection. No information was available concerning this pipe. The status of this pipe will be determined during the next routine inspection at the facilities.

*CO Report No. 289/70-2, paragraph B.1

**CO Report No. 320/70-2, paragraph B.2

3. Potentially Sensitized Stainless Steel Valves*

Met-Ed plant records indicate large diameter stainless steel valves (larger than ten inches) with stellite seats were not subjected to pre-heat during stellite deposition by the TIG welding process on the CF-8 and CF-8M valve bodies.

4. Cracked Stainless Valve (four inch)**

This identified problem is under investigation by Met-Ed. The status of this item will be obtained on the next routine inspection to the facilities.

5. Weld History Records***

The inspector observed that areas on several joints on the river water secondary heat exchangers for Unit No. 1 were being ground down to remove high stress stamp markings. Mr. Shepard stated that these joints will be properly marked with low stress stamps subsequent to completion of the grinding and weld deposit material buildup, if required. This item will be re-inspected during the next routine inspection to the facilities.

6. Reactor Bleed Tanks (RBT)****

The RBT were inaccessible during the inspection. The inspector did not verify that deficiencies on the two PDM Reactor Bleed Tanks had been corrected. The RBT will be inspected during a future routine inspection.

7. CB&I NDT Procedure Qualification Documents*****

CB&I has not furnished copies of the NDT procedure qualification documents to Met-Ed, to date.

K. Cables and Terminations

Mr. Stuebner stated that Met-Ed has taken the position that equipment and cable runs for Units Nos. 1 and 2 must be verified for accuracy to assure that the systems are redundant, are adequate to perform the respective design requirements and are installed according to applicable

*CO Report Nos. 289/70-2 and 320/70-2, paragraph C.1
 **CO Report Nos. 289/70-2 and 320/70-2, paragraph C.2
 ***CO Report Nos. 289/70-2 and 320/70-2, paragraph B.4
 ****CO Report No. 289/69-5, paragraph III.3
 *****CO Report No. 289/70-2, paragraph F.1.c

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specifications and/or codes. Possible methods of verification by site personnel are under study at the present time. Mr. Stuebner said that a study of possible marking and identification of cables to assure that each cable is run according to plant design to preclude checking by "Cable Fault Tracing Equipment" or other time consuming methods is underway.

L. Concrete

The containment concrete for Unit No. 1 was reviewed in accordance with PI 3800/2. The inspection included items 4605.04a through 4605.05.b.7.d. The 4605.06 items could not be inspected due to work stoppage pending determinations concerning declining concrete strength.

The following is a list of procedural and record keeping deficiencies:

1. 4605.04.e.2 - Air content acceptable limits are not specified.
2. 4605.04.f.1 - Procedures are not definitive for curing addressing themselves only to cold weather protection and then in a very general fashion.
3. 4605.04.f.2 - Curing time is not specified.
4. 4605.04.h.2 - There is no procedure to insure that the proper mix design is requested.
5. 4605.04.h.3 - There are no procedures to assure that the proper mix is delivered to the proper location in the time required.
6. 4605.05.b.1.c - Records of cement tests were not available for review.
7. 4605.05.b.1.e - Records on admixture tests were not available for review.
8. 4605.05.b.7.b - No objective evidence was available to indicate the proper mix was requested.
9. 4605.05.b.2 - Mix designs were changed without benefit of test mixes, which is contrary to ACI 301, Method 2 of Section 3' required by QCP-1 and further imposed by Volume 2, paragraph 5.2.2.1 of the FCAR, in that the brand of cement was changed from Medusa, Type II to Allentown, Type II.
10. Although concrete production was halted, an inspection of the plant indicated that the following sequence is followed:
 - a. Sand is charged into a weight hopper at its weight and weighed.

- b. Coarse aggregate is added to the sand and the cumulative weight determined. (All weights are adjusted for moisture content.)
- c. Liquid admix for air entraining is then added from a liquid dispenser into the sand and stone.
- d. Sand is first released at the bottom of the weighing hopper onto an inclined conveyor belt which discharges into a funnel that feeds the transit mix truck.
- e. The remaining sand, aggregate and air-entraining agent are released from the hopper onto the sand cushion previously released.
- f. Cement, water and liquid dispensed retarder admixture of the quantities for the specific mix are added simultaneously from separate chargers to the transit mix truck.

Master Builders' Engineering Laboratory, in their reports dated February 5 and April 12, 1970, describes the sequence for the test design mixes as follows: "Two thirds of the required water was added to the mixer, and the weighed batches of coarse aggregate, cement and sand in that order, placed in the mixer. The required amount of Pozzoloth (retarder) was then added to the sand."

ACI 301 states that admixtures, where permitted, shall be used as follows: "Air entraining admixtures, pozzolanic materials and proprietary chemical admixtures - in accordance with the recommendation of the manufacturer." Master Builders manufactured the admixes and prepared the trial mixes. The trial mix and production mix do not follow the same sequence in proportioning ingredients.

11. Review of trial mix design reports indicate that only five cylinders were prepared from each test batch for testing of compressive strength at 7 and 28 days, with test results for only two cylinders reported for the 28 day test which is contrary to ACI 301.
12. Trial mix curves showing the relationship between water-cement ratio and compressive strength for at least three different water-cement ratios, as required by ACI 301, were not available for review.