

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

Report of Inspection

CO Report No. 289/69-5

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

Date of Inspection: November 3-5, 1969

Date of Previous Inspection: July 23-25, 1969

Inspected By: D. E. Whitesell 12/9/69  
D. E. Whitesell, Reactor Inspector (Construction) Date

F. S. Centrell, Jr. 12/10/69  
F. S. Centrell, Jr., Reactor Inspector (Principal Inspector) Date

Reviewed By: N. C. Moseley 12/10/69  
N. C. Moseley, Senior Reactor Inspector Date

Proprietary Information: None

SUMMARY

Approximately 340 feet of 2 1/2" and 3" ASTM A-312 stainless steel pipe purchased for the radwaste system was rejected for suspected incomplete fusion and use of filler metal. Met-Ed has sent samples to three independent laboratories for evaluation (paragraph III. 4. a.(5)).

A strike by the boilermakers has stopped all work on the containment liner (paragraph III. 7.). Concrete placement cannot proceed until known defects in the liner are repaired. The paper trail for the completed work was reviewed.

The pre-stressed concrete QA procedures and the mill certificates for on site pre-stressing equipment were reviewed.

The QC procedure for "Pipe Welding Control" was reviewed and found adequate. An inspection of the welding shop showed that the procedure was being implemented.

One of six 4" stainless steel valves received from Alloyco for the radwaste system contained a crack in the machined weld prep area (paragraph III. 6. c.). All six valves were rejected pending further evaluation.

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I. SCOPE

A routine, announced inspection was made to the site of the pressurized water reactor being built on Three Mile Island, near Middletown, Pa. The purpose of the inspection was to audit records, to observe the progress of work, and to transfer the primary inspection responsibility to F. S. Cantrell. N. C. Moseley, Senior Reactor Inspector, Region I accompanied the inspectors on November 3 and 4, 1969 to review the organization and construction progress.

II. PERSONS CONTACTED

1. Met-Ed

Mr. Gene Hreczuch, Resident QA Engineer  
Mr. Vern Stuebner, Resident Engineer, Unit 1  
Mr. Will Shepard, " " Unit 2  
Mr. E. Allen, NDT and Welding, QA Engineer  
Mr. G. Kopp, Electrical, QA Engineer  
Mr. Bud Avers, QA Manager (GPU)  
Mr. Neil Goodenough, NDT-Welding QA Engineer (GPU)

2. UE&C

Mr. Milo Prisuta, Site QC Manager  
Mr. H. A. Hardy, Asst. QC Supervisor  
Mr. K. J. Branch, Liaison Engineer, QC  
Mr. Paul Dailey, Civil Engineer, QC  
Mr. Lon Haley, Instrument Engineer, QC  
Mr. Dave Lambert, Mechanical Engineer, Receiving, QC  
Mr. Tom Diarmit, Structural Engineer, QC  
Mr. George Kenny, Welding, Piping Engineer, QC

3. PTL

Mr. B. D. Bryant, Field Supervisor, QC

III. DETAILS

1. Pre-stressed Concrete

a. Inland-Ryerson QC Manual was reviewed. The manual provides for the receiving, handling and storage of the tendon hardware and stipulates the materials of the various components. The records and documentation requirements, relative to the stressing operations, are specified. No deviations from the PSAR commitments were noted. (4705.04)

(1) In addition to the QC manual, Ryerson's "Installation and Tensioning Instruction Manual" was reviewed. This provides detailed instruction for unpacking and installing the tendons and the required equipment and duties of the tensioning crews.

1419 199

- b. A review of the material records was made. The only hardware received to date are the base plates and grease. (4705.05 a.1)
  - (1) The base plate mill certificates show the plates to be in accordance with ASTM A36, hot rolled, 3 3/4" thick fine grain with chemical and physical properties.
  - (2) The chemical analysis for the grease showed the chloride to be less than 2 ppm, nitrates less than 1 ppm and sulfide "not detectable".
- c. The placement of the bearing plates, trumpets, ducts and spiral reinforcement under the plates and around the trumpets were noted to be in accordance with the drawings and details. (4705.06 a.1 & 6)
  - (1) After the concrete has been poured and the forms stripped, all exposed surfaces of the base plate are cleaned and grease applied to prevent oxidation. (4705.06 b.)

2. Containment Liner

- a. The boilermakers have been out on strike since August 1, 1969, and CB&I work has been stopped since August 16, 1969. Copies of CB&I's nondestructive procedures were reviewed previously\*, except for qualifications.
  - (1) The inspector was informed by Mr. Dave Lambert, UE&C Quality Control, that he had reviewed the qualifications of these procedures and the qualification certifications of CB&I's NDT personnel. These records are on site in CB&I's field office. (4805.04 a.3 & 4)
- b. The "as-built" drawing of the containment liner is being compiled on a stretch-out drawing that identifies each plate, heat number, weld number, welder and shows the location of radiographs made, LP examination, visual examinations, leak tests, etc. (4805.04 b. 1, 2, 5 & e.6)
  - (1) Any defect that is found is mapped to show the location and kind of defect. The defects are then ground out, repaired, and re-inspected for acceptance. (4805.04 b.6; f.2 & f.6)
- c. Plates are shipped with their number and heat number stamped on them. The mill certificates are also checked to verify the numbers and materials. (4805.04 g.i & 5405.04 d.2)
  - (1) The purchase order for some of the plates required them to be ultrasonically tested before shipment and the test results are sent to the site with the mill certificates. (4805.04 e.5 & 5405.04 b.3)

\*CO Report No. 289/69-3

- d. The mill certificates were reviewed and the plate numbers, heat numbers, ASTM standards, chemical and physical properties were noted together with required grain refinement and notch toughness test results. (5405.05 a.2)
- e. The ultrasonic test results relative to the plate materials was reviewed. The UT records note the equipment used, transducer size and frequency, the melt and slab numbers, specification number, inspector's name and date. No deficiencies were noted. (4805.05 a.3 & 5405.04 b.3)
- f. A review was made of CB&I's records and UE&C's surveillance reports relative to soap film tests, air pressure tests, halogen leak tests of cover channel welds. Records of the liquid penetrant and leak tests of the welds of 14" stainless steel lines to the containment sump liner, and the welds of the cover channel were also reviewed. Repair of defects and reinspection and test for acceptance were noted. (5405.04 f.5)
- g. Logs for the installation of 16 strain gages, installed to date, were reviewed. These logs note the type of gage, location, date installed, balance and resistance, moisture protection, etc. (5405.04 f.3)

3. Bleed Tanks (PDM)

- a. The PDM file was audited relative to the work on the three bleed tanks, fabricated on site to Section III, Class C of the ASME Code.
  - (1) The welders' performance qualification records were reviewed, and five were found to be in accordance with the requirements of Section IX of the ASME codes. Two are still unacceptable for the same reasons reported previously\*. This item will be followed on the next visit. (4805.05 a.1)
  - (2) The "as-built" drawings are stretch-out drawings and sections of the shell and heads. The heat number of the plate, weld number and locations of the radiographs are noted on these drawings. (4805.04 b.1 & e.6, & 5405.05 a.3)
  - (3) The daily inspection reports covering from 1/27/69 through 4/18/69 were audited. The reports include the inspection of the welds, grinding welds, and dye penetrant examinations. (4805.04 e.2 and e.4, and 5405.06 a.3)
    - (a) Deficiency reports were audited. These reports note the drawing number, purchase order number, and the serial number of the tanks. The deficiency is described and repairs accomplished by dressing out the defect, rewelding and re-radiographing. The deficiency reports are duly signed off, after repairs are accepted. (4805.04 f.2, f.6 and 4805.05 a.4) (5405.04 f.5 and 5405.06 a.3)

- (4) The reports and results of the LP examination of welds in tanks 1A, 1B, and 1C were reviewed. The reports noted the cleaner, penetrant and developer used and the temperature range; no deficiencies were noted. (4805.05 a.3 & 5405.04 2.5)
  - (a) The UT reports for checking the material thickness after grinding out arc strikes, weld grinding, etc., were reviewed. These UT examinations were also made for verification of radiograph interpretations along selected weld joints. The report listed the equipment used, transducer size and frequency, transducer angle, couplant, operator's name and qualified to level II SNT-TC-1A. (4805.04 e.5, 4805.05 a.3, 5405.04 f.5 and 5405.06 a.3)
- (5) The material certificates for the plate and electrode materials were reviewed.
  - (a) The plate material was noted to conform to ASTM 240 type 304; the heat numbers, chemical and physical properties were noted.
  - (b) The material certification for the 308-16, 309-16 and 308 bare filler wire, noted the heat number, lot number and the chemical analysis of the filler metals.
  - (c) No deficiencies were noted in any of the material certifications. (4805.04 g.1, 5405.04 b.1, b.2, d.2, 5405.05 a.1 & a.2)
- (6) It was observed that these tanks are protected from the weather by plywood covers.

4. Piping (UE&C)

- a. UE&C's Quality Control Procedure #QC-8 for "Pipe Welding Control" was reviewed. This procedure references 19 additional QC procedures, and the UE&C "Welding Specification Nuclear Plant Piping." The procedures define the responsibilities and duties of the A&E's Site Engineer, UE&C's Welding Supervisor, UE&C's Quality Control Engineer (Welding and Radiography), Quality Control Inspectors, and the UE&C's Piping Supervisor. The procedures provide for the following:
  - (1) All welding, including repair welding, to be performed by qualified welders using qualified procedures in accordance with Section IX of the ASME B&PV codes. (4805.04 a.1 & a.2)
  - (2) All NDT operators and interpreters are to be previously qualified to the applicable SNT-TC-1A section. (4805.04 a.4)

- (3) Numbered spool sheets are correlated to the work by identifying the system, the system drawing number, the section number, the weld map number, pipe schedule, weld procedures, required nondestructive tests, weld number, welder's number, base materials' heat numbers, and the date. A weld joint history record is prepared for each weld joint. This record notes all the information contained on the spool sheets with the addition of the sign-off of the various QC and NDT requirements. A copy of the front and back of this history record is enclosed as Attachment No. 1 and No. 2. (4805.04 b.1 thru f.6)
  
- (4) Receiving inspection of pipe and fittings for conformance to the required material pedigree and standards, as assigned to the Field Supervisor Quality Control or his designees. This effort is stipulated to conform with the following:
  - a. QC 2 "Receiving and Inspection" (4805.04 g.1)
  - b. QC 3 "Storage Control" (4805.04 g.2 & 5405.04 d.2)
  - c. QC 17 "Control of Nonconforming Materials" (5405.04 c.5)
  
- (5) The inspector was informed by Mr. T. Hreczuch, QA Engineer, Met-Ed, that approximately 200 feet of 2 1/2 inch, and 140 feet of 3 inch, Schedule 40, 304 stainless steel pipe specified to be ASTM 312, fusion welded, had been received at the site. The receiving inspection had alerted the QC Supervisor that part of the pipe was suspected of having filler metal added and part appeared to have a lack of fusion at the center of the weld. As a result, the entire shipment of pipe has been quarantined, and samples have been sent to three independent laboratories for analysis. The lack of fusion for approximately 1/4 the wall thickness in ASTM 312 pipe could cause grave concern, because it not only reduces the wall thickness along this weld, but also creates a stress raiser. ASTM A312 does not require any nondestructive test other than hydrostatic pressure to produce a stress of 50% of the minimum yield. This item will be closely followed by Compliance.
  - (a) All of the suspected pipe has been identified by clearly marking each section "Not to Be Used for Nuclear Service or Seismic I or II". The pipe has been quarantined by placing it in the "Temporary Piping" storage bin, and will be replaced with ASTM A376 pipe.
  - (b) To prevent a re-occurrence of this condition, the piping specifications are being revised to eliminate all ASTM A312 references and specifying ASTM A376 for seamless pipe, and ASTM A358 for welded pipe.

1419 203

- b. The qualifications of UE&C's welding procedures and welders' performances were reported previously. (CO Report No. 289/69-4; 7/23-25/69)
- c. The welding shop was visited where it was observed that the welding procedures, weld rod control, and QC-8, "Pipe Welding Control" were being followed. (4805.06 a.1)
  - (1) When preheat, or interpass temperature is required, the temperature is controlled by "Tempilstiks" indicating crayons. Examination of the purchase orders and QC records show that the Tempilstiks are certified by the manufacturer to be lead free, sulfur free and halogen free. (4805.05 a.3)
  - (2) It was observed that the weld history records are affixed to each weld joint, until the final weld has been radiographed and accepted, after which the weld number and the welder's identification mark are stamped on the pipe. In this manner, the inspection and test status of each weld joint is maintained, from the start of the weld, through the repair of any defects, to the final radiographs and acceptance. (4805.05 a.4 & 4805.06 a.3)
  - (3) It was observed that when the shipping container is opened, all coated electrodes are placed in holding ovens located in a controlled storage area in one corner of the shop. Each type of electrode, e.g.; stainless steel and carbon steel, have separate ovens. Electrodes are issued in small quantities by the attendant in charge of the storage area. There are smaller individual holding ovens in the weld areas. No electrodes other than the ones being used were observed in the area. (4805.06 a.5)

5. Records

- a. All the mill certificates and NDT reports and results mentioned above are maintained in steel file cabinets located inside a fireproof vault. Any QC records maintained in field offices are maintained in steel filing cabinets that are encased in approximately 3/4" asbestos cement board that has been tested in the field to have a fire rating in excess of 2 hours.
- b. In addition to the normal field generated QA-QC documents, records are also available for review at the site relative to the evaluation of the QC programs of some of the vendors. Trip reports are also available relative to the surveillance and audits of vendors' inspections, e.g.; Chapman Valve Division of Crane Co.

6. Implementation of Procedures

1419 204

- a. The inspectors were informed by Mr. Bud Avers, QA Manager, GPU, and Mr. Milo Prisuta, Field Supervisor-QC, UE&C, that a school was being held for all of the construction supervisors and craft foremen, to acquaint each of them with the procedures and instructions applicable to their specific field of responsibilities. The supervisors and foremen are then held responsible to enforce strict adherence to these procedures by the craft in their execution of the work.

- b. During this visit six 4" stainless steel gate valves were received from Alloyco for use in the radwaste system. Upon receipt inspection, a crack was found in the machined weld prep area, and also evidence of grinding dust indicating unsatisfactory cleaning. The Supervisor-Quality Control ordered all the valves in the shipment to be tagged as rejected and left in their shipping crates until a vendor's representative could be brought to the site relative to their replacement.
- c. The inspector was informed by Mr. Hreczuch, Met Ed, QA Engineer, that UE&C has been instructed to develop procedures for proof testing of hoisting equipment, including slings, yokes, chokers, etc. While this is primarily a safety item, it will reduce the probability of damage to critical equipment, through mishandling or dropping, by reasons of the use of inadequate or substandard equipment.
- d. It was observed that rotating equipment that is now stored in place has a log attached showing the date that the equipment had been rotated. The frequency of such rotation is in accordance with the manufacturer's recommendations.

7. Concrete

Concrete work on containment has reached a standstill due to a strike by the boiler-makers. Defects in the containment liner must be repaired before any more concrete is placed for the shell of containment. The batch plant was operating to provide concrete for the flumes from the cooling tower, and for the mud mat for Unit No. 2. The inspector inspected concrete for the above two placements.

a. Preplacement QC Inspection (4605.06 a.3)

An inspection form is used to show that the site has been properly prepared for placement of concrete. Attachments 3, 4 and 5 show the form used. (The same form is used for both Units 1 & 2.) The forms were filled out and signed by the UE&C crafts and the Job Engineer. A separate but similar form was filled out and signed by PTL to authorize the batch plant to manufacture concrete for that location. The inspector checked the location prior to placement of any concrete and noted that the forms were secure, the area was clean and free of water, and was in proper condition to receive concrete.

b. Slump, Strength, and Entrainment Test (4605.06 a.5)

- (1) Slump tests were made on the contents of each truck at the site. The procedure (QC-1) requires a minimum of one test per 50 yds. of concrete placed.
- (2) A set of ten cylinders were cast from the second bucket of the first truck unloaded. The procedure requires that the cylinders be made and cured per ASTM C31.66 for each 100 yards of concrete placed. The procedure requires all cylinders be prepared from the middle 80% of one truck load of concrete. The field practice is to make a set of cylinders for each 50 yards of concrete placed.



The ten cylinders cast included two extra cylinders required because of the anticipated overnight low temperature. The procedure requires these two cylinders to be field cured at the site of the pour when there is a possibility of air temperatures below 40°F or above 90°F.

- (3) A check of air entrainment was made on the first four truckloads delivered to the site. The first two trucks were rejected by the PTL inspector because of low air entrainment - < 4%. (3.6% & 3.8%). An additional gage was obtained and the third truck was accepted based on an average of the two gages (3.9 and 4.1%). An adjustment of the air entraining agent and water content was made to the fourth truckload at the batch plant. The air entrainment was checked and found satisfactory before the truck was unloaded. The procedure requires checking the air entrainment at least once for each 50 yards of concrete placed.

c. Proper Placement (4605.06 a.6)

Tremies were set up on ~6 feet centers prior to the start of placement. During the placement of the first load, the UE&C inspector noted that excessive horizontal movement would be required to reach one corner of the form and he had another tremie set up for that corner. The crew size was adequate to handle the placement of concrete, set up another tremie and operate the two vibrators used for compacting the concrete. The work observed was satisfactory.

d. Delivery of Proper Mix (4605.06 b.5)

The inspector observed that concrete identified as 3000 psi concrete was being prepared at the batch plant and delivered to the site as required. The PTL inspectors were concerned and were checking times and mixing speeds to be sure that overmixed concrete was not used as a result of the delay caused by the batches rejected because of low air entrainment.

e. Quality Control Inspections (4605.06 b.8)

UE&C QA and Pittsburgh Testing Laboratory QC personnel were observed at the site of the pour. One UE&C QA Engineer was at the site auditing the testing and placement of concrete. PTL had three inspectors and a supervisor following the testing and placement of concrete. After the initial problem of low air entrainment, the placement proceeded in a satisfactory manner.

f. Implementation of QA Program

UE&C is the construction contractor and is constructing the concrete portion of the plant. Quality control surveillance of the manufacture and placement of concrete is performed by an independent testing organization, Pittsburgh Testing Laboratory (PTL).

257

A PTL inspector observes the preparation of cadweld splices, and must approve the finished splice. Selected splices are cut out and pulled to destruction in the testing laboratory that has been erected on the site. The results are reported to UE&C's QA organization. These reports, together with the mill certificates and receiving inspection reports for the rebar and the cadweld splice kits, are kept by UE&C. This file is available for inspection by the owner and his QA organization.

PTL has one or more inspectors at the concrete batch plant. The principal inspector is responsible for checking that the proper materials are being used in proportions required by the batch design. PTL checks the moisture content of the aggregate and is solely responsible for adjustments in the water content of the mix.

PTL inspectors at the pour site have an inspection check sheet that must be completed prior to approving the placement of any concrete. This inspection includes verification of the condition of the forms, the pour base, and the location, size, and splicing of reinforcing steel. The PTL inspector performs slump tests, checks the air entrainment, the batch temperature, the truck revolution counter, and prepares test cylinders as required by procedure. At least one other inspector observes the concrete placing operation for compliance with requirements of the procedure and good practice.

The PTL inspector, the UE&C concrete superintendent, or the UE&C QC auditor can reject a load of concrete for failure to meet specifications. A record is maintained of the disposition of each load of concrete. Records of the above test reports, inspection and audits are maintained by the UE&C QA group, and are available for inspection.

Quality assurance audits of the concrete manufacturer and placement and PTL's quality control surveillance are made by the Architect-Engineer, Gilbert Associates (GA). Additional quality assurance audits of the efforts of UE&C, PTL and GA are made by the owner, Met-Ed, and MPR Associates, for the owner.

A weekly quality assurance meeting is held at the site to review performance in all areas, including concrete. Minutes are kept to document the action taken or required on specific problems. A monthly meeting is held at the home office of UE&C to review overall progress.

A review of records and discussions with personnel at the site show that the above QA-QC organization is functioning as described. This organization exceeds the requirements for QA-QC outlined in the PSAR, and meets the intent of the proposed QA Criteria in Appendix B, 10 CFR 50, published April 17, 1969.

1419 207

8. Cadwelds

Certificates for cadwelding powder and sleeves were reviewed. The powder was certified to meet "cadweld specification." Analyses were not included with the certificate. The sleeve analyses were satisfactory. (Min. tensile strength 70,000 psi.)

The inspector discussed the problem with cadweld powder found at Ocone\*. Records did not indicate any of the defective batches at TMI. Mr. Dave Lambert stated that during the summer of 1968, one batch of powder did not appear to be firing properly and the batch was discarded after two splices tested low. The powder is stored in a low humidity trailer. A minimum amount was noted to be on hand.

IV. EXIT INTERVIEW

1. An exit interview was held with Mr. Gene Hreczuch, Site QA Engineer, Met-Ed, Mr. Milo Prisuta, QA Manager, UE&C, and their respective QA staff.

A discussion was also held by phone with Mr. Vern Steubner, Resident Engineer, Met-Ed, subsequent to the inspection.

The inspectors stated they had not found any deficiencies in the records audited or noncompliance in the work observed in the field.

3. The suspected problem with the 2 1/2" and 3" stainless steel pipe that was rejected was reviewed briefly. Mr. Hreczuch reaffirmed that Met-Ed would send Compliance a copy of their report of their investigation.

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\*Memo from J. P. O'Reilly, September 24, 1969

1419 208