

COMPLIANCE INVESTIGATION REPORT

DIVISION OF COMPLIANCE

Region I

Subject: OYSTER CREEK STATION #1  
Lacey Township, N. J.  
License No. DPR-16  
Docket No. 50-29 219

Type of Case: Allegations that piping, fittings, and valves installed at Oyster Creek Station #1 do not meet ASTM, or ASME Codes or A/E specifications.

Period of Investigation: February 28, 1969 to April 16, 1969

Investigation Team: Robert T. Carlson  
Joseph H. Tillou  
Alvin F. Ryan  
John W. Flora  
John J. Ward  
Roy M. Gustafson

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REASON FOR INVESTIGATION

On 2/28/69, CO:I received a letter dated 2/21/69 from Dr. Roscoe E. Kandle, Vice-Chairman, New Jersey Atomic Energy Council, reporting that on Thursday, 2/13/69, Alexander A. Cella and Paul B. Kiebler, of Pipeco Steel Corporation, Dover, N. J., had informed representatives of the Public Utilities Commission that pipe had been supplied for use in Oyster Creek Station Number One that did not meet appropriate specifications.

On 2/28/69, N. C. Moseley telephoned to A. A. Cella who made the following statements:

1. Material was supplied, with the knowledge of subcontractors and fabricators, by firms who ignored purchase specifications and ASME Codes.
2. Material was supplied by firms who were not qualified to manufacture it and were not distributors of any of the known qualified manufacturers.
3. In some cases, material certificates which were provided were falsified or improperly verified.
4. Prior to placing orders with fabricators, inspections were not made of the fabricators' shops or quality control program.

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The investigation was initiated by CO:I on 2/28/69 when N. C. Moseley, Senior Reactor Inspector, CO:I, telephoned to A. A. Cella at his office to obtain specific details of the allegation in Kandle's letter to CO:I. Cella declined to be specific in his statements.

INTERVIEW WITH A. A. CELLA ON 3/11/69

*reason for  
delay*

In an interview with A. A. Cella on 3/11/69 at his office in Dover, N. J., Joseph H. Tillou, Reactor Inspector, CO:I, and Alvin F. Ryan, Investigation Specialist, CO:I, were informed of the following additional allegations:

1. That Burns & Roe bought used valves for use at Oyster Creek #1, had them rebuilt by a Clifton, N. J. firm, and then requested Cella, who owns Universal Testing Company at Cedar Grove, N. J., to test and certify the valves to specifications. Cella refused and the tests were done by an unidentified New York City testing organization.
2. General Electric Company bought piping material at a 40% saving in cost in Japan with no reliable material certifications. Burns & Roe bought piping material from Sandvick Pipe and Tube Corporation (Sweden) with no reliable material certifications.
3. That Consolidated Edison had rejected all piping material received from Dravo and replaced it with material from Pipeco.
4. That at Dresden II, Ladish was given the contract for the pipe and fittings. Ladish makes only fittings. It bought the piping material from the U. S. distributor for Sandvick, whose material certificates, according to Cella, are known to be unreliable.
5. Ebasco was prime contractor on a reactor project for Idaho Falls (later (4/15/69) identified by Cella as the site at Scoville, Idaho). Howard and Wright, subcontractor, ordered pipe to Ebasco specifications from National Standard Piping Company who, in turn, on 10/17/68 placed an order with Pipeco for A-312. This was rejected by Ebasco as not meeting its specifications. The order was replaced by Pipeco with a 6 months delay.

ANALYSIS OF ALLEGATIONS

The statements, charges and allegations related to Oyster Creek #1 made by Cella were analyzed. Seven allegations were identified.

The information on which the seven allegations are based was not specific and the allegations as set out herein represent the best interpretation of the investigating team. The allegations and information to support or refute them, obtained by interview, record check or observation, are set forth as follows:

1. Piping was supplied for use in Oyster Creek #1 that was designated A-312 F. M.
  - a. There are stainless steel piping and/or fittings in each of the following systems: core spray, isolation condenser, shutdown cooling, and the cleanup demineralizer that are welded with filler metal. These were observed by Tillou, Ryan, Carlson, Gustafson and Avers of (General Public Utilities) in the period from March 18 to 26, 1969.
  - b. Butt weld radiographs that were examined by Tillou show longitudinal seams, made with filler metal in all the above systems, except the cleanup demineralizer. Radiographs of butt welds in the cleanup demineralizer system were not checked. Accessible pipe observed in the cleanup demineralizer system is seamless. This was observed in the period from March 20 - 25, 1969.
  - c. Inspection of accessible installed pipe by Tillou, Carlson, and Gustafson revealed two designations of "welded A-312 A & P" in the isolation condenser system and "312 A & P" in the core spray system on 8 inch diameter schedule 80 pipe supplied by Alloy. This size and schedule of pipe cannot be manufactured by Alloy without filler metal being used, according to a statement made to John W. Flora on April 8, 1969 by W. O. Strong, A., former General Manager for Alloy.

*50 why  
E. Sciffell  
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- d. Alloy marked 10-inch schedule 40 pipe made with filler metal as "welded A-312 A & P" on at least one occasion. This was observed by Flora on April 8, 1969 in the Alloy storage yard.
- e. In the General Electric design criteria for Oyster Creek #1, Revision 3, dated July 13, 1964, the pipe specification recommended was ASTM A-376, A-312, and A-358, Class I. According to Guido A. Lari, Project Engineer for Burns & Roe, Inc., there were procurement problems which would delay delivery of the specified pipe. Lari met with Robert A. Huggins, of General Electric, on October 7, 1966, and had a telephone conversation on October 10, 1966 with J. Larrew. As a result, General Electric, in a letter dated October 10, 1966, stated its criteria on piping for the Emergency Condenser System, originally outlined A-312 (seamless or welded pipe), or as an alternate, A-376 (seamless pipe). The Burns & Roe specification required seamless pipe for this system. The letter concluded with the statement that welded pipe is acceptable for this application and that General Electric understands that Burns & Roe will perform stress analysis based on the use of welded stainless steel pipe and specify the necessary pipe schedule. On the basis of this letter, Lari notified Tubeco, which had been given the purchase order for fabrication of the piping and fittings, that welded pipe would be acceptable, but did not limit this change to the emergency condenser system, as stated in General Electric's letter dated October 10, 1966. Tubeco then issued a purchase order to Albert who, in turn, ordered about 700 feet of A-312 welded pipe with

*to whom*

*backtrack  
not logical*

*too  
long  
hard to  
understand  
very important*

100% radiography from Alloy. On July 31, 1967, W. O. Strong, Jr., General Manager for Alloy, in a letter to Tubeco which was a material certification, stated that filler metal had been used to fill the order.

f. No pipe <sup>specifically metal</sup> identified "A-312 F. M." has been seen by regulatory representatives at the Oyster Creek #1 facility. No reference in documentation examined has been made to A-312 F. M.

g. Contrary to Burns & Roe's written specifications which called for seamless fittings, Tubeco, fabricator of 3 of the above 4 systems, ordered welded fittings to ASTM A-403 purportedly on verbal authorization from Burns & Roe (see e. above).

*what did  
B&R specs say  
in changing orders*

2. All 6-inch, 8-inch and 10-inch diameter pipe is rejectable either by underweights or the addition of filler metal.

a. Not all (see 1.b.) pipe is made with filler metal. It has been established that much of the Oyster Creek #1 stainless steel pipe is made with filler metal (see 1 above). There has been no evidence to indicate underweight pipe is installed at Oyster Creek #1. On the other hand, there is insufficient documentation available to show that all stainless steel piping is within the appropriate weight applications.

b. It should be noted that if pipe were fabricated to the requirements of the purchase order, (example, i.e. above), the thickness requirements of A-312 would be applicable. The resulting pipe could be underweight by the standards of A-358 which in the diameters of interest requires thicker walls than does A-312. (See table below.)

Pipe Diameter	Sch. 80 (USAS) (B36.19)	Minimum Acceptable <sup>(1)</sup>		Available Certified Values <sup>(2)</sup>
		A-312	A-358	
6"	.432	.378	.422	.431
8"	.500	.437	.490	.500
10"	.594	.520	.584	.593

Note (1) Tolerances in thickness of the plate are as follows

For A-312, 15%

For A-358, 10 mills

These tolerances have been factored into the above table.

Note (2) ~~not used~~ A few (~ 5) certifications of thickness of plate used by Alloy have been seen by regulatory representatives. No values were less than the minimum thickness requirements of A-358.

c. Contrary to Huggins' understanding in his letter to Burns & Roe, Inc., dated October 10, 1966, Burns & Roe has not performed a stress analysis to verify the mechanical acceptability of welded pipe-filler metal as a substitute for seamless pipe. This information was obtained from Lari at an interview conducted 3/26/69 by Carlson, Ryan, and Gillion.

3. Six-inch, eight-inch, and 10-inch diameter fittings at Oyster Creek #1 are suspect because nonqualified welders were used and no final testing at CO on welding was done.

a. Of the few systems chosen by CO for consideration (see 1.a. above), at least eight firms supplied fittings. Two can be eliminated because either no welding was involved or their fittings were larger than those specified in the allegation. Alloy is the latter case.

b. Of the remaining six suppliers two were selected for examination by CO based on the availability of documentation (at B&R) and the number of fittings supplied by each firm (about 40 each)

In the case of Alaskan Copper, certification that A-403, the pertinent specification, was met gives assurance that the welders were qualified under Section IX of the ASME Code (see 3(f)(1) of A-403). In this same case, reports of satisfactory results from radiography examination of the fittings (the radiography done by Pittsburgh Testing Laboratory) were available. In the second case, Swepeco Tube Corp., Tillou examined 14 radiographs (total) of a short ell, long ell and a reducer. These radiographs were of excellent quality; they revealed no defects. Also, the qualification record of the lone welder used for the work was in order.

- c. It is to be noted that if the requirements for final inspection of a fitting are those given in A-403, only 100% weld radiography, plus a limit on weld reinforcement, need be met on the finished product. However, since Burns & Roe specified seamless fittings and many eventually were supplied as welded fittings, there is a question as to which ASTM specification must be satisfied. If the supplier resorts to A-358 (welded pipe) as his starting material, which is permitted as an alternate to A-312 (seamless pipe), then all testing requirements imposed by A-358, including hydrostatic, bend, analysis of weld metal must be conducted. These tests would be performed on the starting material, not the formed fitting.

The following firms supplied fittings as indicated:

<u>Lenape</u>	<u>Alloy</u>	<u>Ladish</u>	<u>Alaskan Copper</u>	<u>Swepeco</u>
Flanges	welded 14" & 16"	seamless (cleanup demineral- izer system)	welded 37-7" elbows 2 reducers	welded 39 elbows 2 reducers (welded)
<u>Tube Turns</u>	<u>Liberty Equipment &amp; Supply</u>		<u>Sun Weld Fitting</u>	
Tees & elbows	Reducers - elbows		Reducers-tees-elbows	

4. The firms that supplied the pipe material in question (presumably A-312 F. M.) were neither qualified to manufacture it nor distributors of any known qualified manufacturers.
    - a. Of the few systems chosen for analysis (see 1.a. above), CO has found, deductively, that only one firm, Alloy, could be the subject of the allegation. The other firms involved, Albert Pipe Supply, Inc. and Tubeco, Inc. are either a recognized supplier (Albert) or pipe fabricators (Tubeco).
    - b. Flora, during a visit to Alloy on 4/8/69, was told by Strong, former General Manager for Alloy, that the firm is today, as it was two years ago, incapable of manufacturing welded pipe with wall thickness greater than 0.375 inch without the addition of filler metal. All 6-inch, 8-inch, 10-inch pipe in question has wall thicknesses of 0.378 or greater. Therefore, it can be concluded that Alloy was not a qualified manufacturer of nonfiller metal pipe of the sizes ordered by Albert. Note: Tillou has determined that with special equipment, A-312 pipe can be manufactured today without the use of filler metal to thickness not exceeding 0.500 inch.
    - c. A related allegation was that "material was supplied by firms who ignored purchase specifications and ASME codes. This was done with the knowledge of subcontractors and fabricators." (Alleged by Cella to Moseley on 2/28/69.)
- ④ This complaint could relate directly to the fact that Tubeco's order demanded manufacture of pipe that was impossible for Alloy to fulfill. Addition of 100% radiography of the longitudinal weld seams invited the conclusion that there was a reluctance on Tubeco's part to order the pipe to the A-358 Code, which requires additional tests (weld metal

analysis, face and root bend tests, 75% yield strength, hydrostatic, etc.).

5. Material certificates were provided that were found inadequate or were only supplier affidavits instead of original mill certifications.
  - a. On March 21, 1969, subsequent to initiation of the CO investigation into this matter, Burns & Roe addressed a letter to Tubeco, the principal pipe fabricator, requesting:
    - (1) that Alloy certify radiography was done to N-7 to B31.1 on the fittings it supplied; (2) that Alloy correct six of its certifications to show that plate for the piping material it supplied conformed to Type 316, A-358; (3) that fittings produced by Alloy were automatically welded to the specified procedure; (4) that Swepeco certify that radiographic examination of longitudinal seams on elbows it supplied was performed; (5) that Tube Turn provide certification of material and weld radiography on two 10-inch elbows it supplied.
  - b. Following the CO Quality Assurance Task Force inspection of Oyster Creek #1, General Electric determined by way of an inventory and review of construction records numerous instances of inadequate documentation. (See CO Report Nos. 219/68-5, 68-8, 68-10, 69-1).
  - c. In "corrected" certifications supplied by Alloy dated April 3, 1969, different physical test results are given for the same heat, whereas the chemical test results are identical, indicating a single sample.

In an interview on 3/28/69 at Tubeco, Arthur A. Greene, Vice-President of Tubeco, informed Carlson, Ryan, and Tillou that on March 25, 1969 he had sent a letter to A. W. Galbraith formerly of Alloy, requesting that specifications for material supply be changed from A-312 to A-358. In response to th<sup>is</sup>

letter, Greene had received a telegram from Galbraith stating that he would certify that the pipe had been manufactured to Specification A-358, not A-312. The original certifications in the possession of Greene were not made available to the investigators for subsequent comparison with the corrected certificates.

*did we ask?*

6. A-312 seamless or welded pipe for Oyster Creek #1 was substituted for Burns & Roe Specification A-376.
  - a. The Burns & Roe specifications typically call for either seamless ASTM-A-312 or ASTM-A-376 pipe on an equally acceptable basis. The specifications do not mention A-312 welded pipe, a subject treated in Item 1. above.
7. Some used valves, the certifications of which were inappropriate, were used in Oyster Creek #1. Reportedly, a Clifton, N. J. firm (unidentified further) requested Universal Testing Co., owned by Cella, to test the used valves and certify them for use.
  - a. Messrs. G. A. Lari and H. Jung, (B&R) and L. Loeb, (GE), have stated to CO representatives that no used valves were installed in critical systems at CO:1.
  - b. In a subsequent interview conducted with Cella on April 15, 1969, Cella stated that an individual he knew in Clifton, N. J. had approached him to have used valves, bought by Burns & Roe from a New York supplier, tested and certified for use. On April 16, 1969, Cella informed Ryan that he had been informed that Burns & Roe had bought about \$60,000 worth of stainless steel valves in sizes 1/2" up to 2" from Bergen Industrial at Clifton, N. J. According to Cella's informant, Bergen had obtained the valves from Metropolitan Supply Company, which Cella characterized as a "junk yard", which dealt in used materials for which it could not have any documents correctly certifying to the manufacture of the valves. When questioned about valves in the 6-inch

8-inch, and 10-inch sizes, Cella stated he had no specific information that used valves were among these.

In addition to the allegations set out above, Cella had stated that General Electric bought most of the piping material in Japan and would not have reliable material certifications for it. In inspecting piping that was accessible at Oyster Creek #1, no piping identified as having been manufactured in Japan was observed. In addition, Lou Loeb of General Electric, and Guido A. Lari of Burns & Roe, Inc., both stated that no piping manufactured in Japan had been procured or installed at Oyster Creek #1.

Another allegation by Cella was that Burns & Roe, Inc. bought everything possible from Sandvick Pipe and Tube Company in Sweden and would have no reliable material certificates. In the cleanup demineralizer system in which the accessible piping was observed to be seamless, the number of pieces therein were stamped identifying them as having been manufactured by Sandvick.

CONCLUSIONS

By direct observation at the Oyster Creek #1 site, documentation reviewed, and interviews with key individuals, information has been made available which supports the conclusion that piping has been installed at the facility that does not comply with the specifications invoked originally by Burns & Roe. Additionally, allegations that unqualified manufacturers supplied pipe, and that inadequate material certifications were provided, have also been found to have substance.

At this time, it is not possible to reach a conclusion as to the veracity of the allegation concerning the installation of used valves.

Substitution of A-312 pipe for A-376 pipe which is alleged to have occurred, has no adverse technical implications.

*Don't miss?  
check*

## RECOMMENDATIONS

Inasmuch as there is evidently a considerable amount of pipe and a few fittings in the Oyster Creek #1 auxiliary systems which do not comply with the original specifications, <sup>and</sup> about which little documentary evidence is available, an effort to verify the serviceability of the pipe must be undertaken. This verification could take the form of documents relating to the history of the manufacture of the pipe, if they should become available, certification of the pipe to the requirements of a specification, ~~say~~ <sup>say</sup>, (A-358) that is mutually acceptable to the licensee and REG, or the application of certain tests on the installed pipe and/or specimens taken from it. *Since the latter option appears to be the most likely to be proposed by the licensee,*  
*a* review of the tests that might be made on the installed pipe and fittings, <sup>or samples from them</sup> ~~if samples were taken from them~~, is appropriate. These tests are listed below, along with the ASTM specifications that are related to this case, <sup>and</sup> by which the test(s) or determinations are required.

- I. Radiography (A-358 - Class I <sup>type</sup> ~~type~~, A-403).
- II. Chemical Analysis parent metal (A-240, A-530, A-358, A-312, A-403, A-376)
- III. Chemical analysis of weld metal (A-358, A-403)
- IV. Tensile tests of the deposited weld metal (A-358, A-403, A-376S, and A-312-S)
- V. Tensile tests of parent metal. (A-240, A-530, A-376, A-312, A-403)
- VI. Yield strength determination (A-240, A-376, A-350, A-312)
- VII. Transverse guided-bend weld test (A-358)
- VIII. Flattening test (A-530, A-376, A-312)
- IX. Bend test (A-240)
- X. Hardness determination (A-240)

- XI. Minimum thickness check. (A-240, A-312, A-403, A-376, A-358, and A-530)
- XII. Penetrant examination. (A-358-S, A-403-S)
- XIII. Ultrasonic tests (A-403-S, A-376-S)
- XIV. Hydrostatic tests (A-358, A-530, A-376, A-403, A-312)
- XV. Elongation examination (A-530, A-312, A-376, A-240, A-358, A-403)
- XVI. Edge test (A-376-S, A-312-S)
- XVII. Photomicrography (A-403-S, A-376-S)
- XVIII. Intergranular corrosion bend tests (A-403-S ~~to~~ A-262)
- XIX. Hot ductility tests (A-376-S)
- XX. Ferrite determination (None)

Six fittings and about 700 feet of pipe were supplied by Alloy. The pipe was made of steel from six heats. *Unless further info is obtained, for present purposes,*

*Rec:*  
① Put burden on A.E.  
②

we will assume that the fittings were made of steel from the same heat. *As an example, based on info currently available,* A program of inspection and testing that can be accomplished *by a reasonable expenditure of effort,* which would give adequate assurance of the serviceability of the pipe is outlined below. The program is proposed on the assumption that hydrostatic testing at pressures higher than one and one-half times the design ~~is~~ pressure is not possible, that no radiographs of the longitudinal seams ~~that are of acceptable quality,~~ are available, and that no documentation exists to demonstrate the pipe was manufactured and tested in accordance with the requirements of ASTM Specification A-358.

Step 1. Remove the insulation from 70 feet (10%) of the piping, and all fittings. The exposed piping and fittings shall represent ~~each~~ *all the* heats of steel that ~~was~~ *was* used to make the suspect pipe and fittings. (This will require some exploration by the removal of short runs of insulation at pipe joints to gain visual access to heat stamps.)

- Step 2. Drain systems and remove a short run of pipe (minimum of 12") at the location of girth welds (that join steel from different heats; <sup>if possible</sup>). For the seven hundred feet of pipe this could be as few as three specimens.
- Step 3. Radiograph, by the best method possible - probably double-wall, except near the locations where specimens were removed in Step 2 - all longitudinal seams that are exposed.
- Step 4. Subject samples removed from <sup>12-12h-1000</sup> ~~12" long~~ excised pipe sections to the following tests. Tests are to be done on steel made from each heat.
- Tensile, yield, and elongation (See A-358, Section <sup>3.2</sup> ~~8.10~~)
  - Flattening (See A-530, Section 4.3)
  - Chemical analysis of weld and parent metals (See A-358, Section 7.1)
  - Hardness (See A-240, Section 13.A)
  - Guided bend test (See A-358, Section 9.1)
  - Intergranular corrosion tests that include both longitudinal and girth welds (See A-240, Section 15.B <sup>A-262</sup>)
- Step 5. Check the ferrite content of all longitudinal seams exposed.
- Step 6. Ultrasonically examine all exposed pipe surfaces, including welds.
- Step 7. Examine the pipe stampings to verify they were not made with stress inducing stamps.
- Step 8. Weld replacement pipe into places where sections were excised, <sup>and</sup> nondestructively examine the welds made.
- Step 9. Replace insulation and refill systems.

The above tests and determinations will give assurance of the following:

- Step 3. The longitudinal welds are sound.
- Step 4. (a) The physical properties of the pipe are consistent with the requirements of the design.
- (b) The ductility and soundness of the pipe and welds is acceptable.
- (c) The ~~ferrite~~<sup>parent</sup> and weld metal are chemically constituted to give the corrosion resistance expected.
- (d) The correct weld electrode was used.
- (e) Fabrication of the pipe did not compromise the ability of the plate to meet the hardness standards.
- (f) The welds were made by competent people using the correct materials.
- (g) The heat treatment history of the metal is acceptable.

Step 5. The appropriate weld metal was used, the corrosion resistance ~~was~~<sup>is</sup> adequate, and the physical and chemical tests results obtained from ~~the~~<sup>excised</sup> samples are representative of all exposed pipe, and thereby all pipe.

Step 6. There are no laminations in the ~~ferrite~~<sup>parent</sup> metal, the welds are sound, and the thickness of the pipe is adequate.

- ① Fabrication of all piping, valves & fittings in class I system - [eg. Vendor, original spec, changes, detail, records available]
- ② For any case above of a problem or record deficiency:
  1. perform a suitable test - and
  2. provide suitable certification
- ③ 100% radiography - certain exceptions
- ④

Step 7: No localized stress concentrations were introduced following fabrication and heat treatment.