March 26, 1969

A. B. Holt, Chief
Materials & Metallurgy Branch, DRS

REPORT OF VISIT TO OYSTER CREEK NUCLEAR POWER STATION, JERSEY CENTRAL POWER & LIGHT COMPANY, LACEY TOWNSHIP, NEW JERSEY BY R. M. GUSTAFSON, DRS, ON MARCH 18-21, 1969

A visit was made by the writer to the Oyster Creek Nuclear Power Station to inspect 6", 8" and 10" stainless steel piping used in various systems of the reactor.

The purpose of this inspection was to determine the validity of allegations, attributed to Mr. A. Cella and Mr. Paul Kiebler, President and Vice-President, respectively, of Pipeco Steel Corporation, Dover, New Jersey, that the stainless steel piping and fitting used in various piping systems in the Oyster Creek Reactor were not in accordance with ASME Code requirements and were not suitable for use in a nuclear reactor system. A summary of these allegations were prepared by CO, Region I, and a copy is attached as Enclosure I.

Prior to visiting Oyster Creek, the writer visited the CO Region I office in Newark, New Jersey on 3/18/69 and discussed the proposed visit to Oyster Creek with Mr. Robert Kirkman and Mr. Robert Carlson. Mr. Kirkman indicated that representatives from his office had visited Pipeco Steel Corporation and had discussed with Pipeco personnel, the allegations which the State of New Jersey had referred to AEC for investigation. Mr. Kirkman indicated that Pipeco did not want to become involved, and stated that any allegations attributed to have been made by them, would be denied.

An investigation of the allegations had been started by CO Region I, with Mr. John Flora and Mr. Alvin Ryan assigned to pursue the matter with Burns & Roe, Architects & Engineers for the licensee. Some of their findings will be discussed later in the report.

A review was made of various sections of Burns & Roe Specification S-2299-60C dated August, 1966, entitled "Piping Reactor Building, Phase I and Phase II, Main Mechanical Equipment Installation and Miscellaneous Equipment."

Jersey Central Power & Light Company
Oyster Creek, New Jersey
General Electric Company
Atomic Power Equipment Department
San Jose, California.

Attached as enclosure (2), is a copy of the various sections reviewed, and the information obtained. Interesting to observe is the fact that the material specified for use in the Piping systems is Seamless Stainless Steel, ASTM-A 312 or ASTM-A 376, Grade TP 316, with various thicknesses designated for the different systems.

On 3/19/69 the writer and Mr. Robert Carlson, Senior Reactor Inspector CO Region I, visited the Oyster Creek Reactor Site, and met with the following people:

Mr. D. Willett - Project Engineer, General Electric
Mr. T. McCluskey - Supt. Jersey Central Power & Light Company
Mr. T. Ross - Engineer - Jersey Central Power & Light Company
Mr. N. Strand - Engineer, General Electric

Mr. Carlson, explained the purpose of the visit, but carefully refrained from giving specifics of the allegations and the source of the information.

Mr. Willett stated that General Electric was very concerned with the matter. They were deeply perturbed about the manner in which the investigation was being pursued, and the method of their notification. He indicated that G.E. felt they should have been made aware of the allegations at the earliest possible moment, and given an opportunity to explain their position in the matter, before starting an investigation.

They requested that the source of the information be revealed. Mr. Willett stated that the major point of issue was that G. E. "was being exposed the claims of any "kook" coming in off the streets and making allegations." They were concerned that this could establish a pattern, and since they have a number of plants under construction, this precedent could result in a very unsatisfactory situation. Mr. Willett further stated that their records had been open to AEC inspectors for over 1-1/2 years and no complaint had been received. However, now, after the piping had been approved and accepted by AEC, they were being called to respond to serious charges, without proper explanation of why they were required to do so.

Mr. Willett again requested that the accusers be identified, that the exact nature of their allegations be revealed and that a statement be issued as to why AEC felt that an investigation was warranted at this time.

He further stated that the G.E. legal people had advised him that nothing in the way of an investigation should be permitted until General Electric had been fully briefed on the matter.

Following this discussion, Mr. Carlson notified AEC-HQ-CO of G.E.'s position. Mr. Carlson was instructed to secure permission from Mr. Ritter, V. P. of Jersey & Power & Light Company to enter the plant, investigate pertinent piping, and review any documents which were deemed necessary. Jersey Central, through Mr. Ritter, cooperated and G. E. was subsequently notified of their decision.

Mr. Willett, following notification of the results of discussion with AEC and Jersey Central indicated that he was aware that he could not deny access to the plant for inspection purposes by AEC personnel. However, since AEC refused to divulge the source of their information; he,on the advice of GE legal people, would have to be uncooperative in the inspection.

Investigation of the piping was started at approximately 3:30 P. M. on 3/19/69.

It was observed that approximately 90% of the piping was covered with insulation, the scaffolding had been removed, that access to the piping would be difficult, and that the lighting conditions would be marginal for proper examination of the piping.

The first stainless steel piping examined was located in the supply and discharge lines in the drywell, and were part of the Reactor Shutdown Coolant System. The pipes designated as (NV-1 and NV-2) were 14" in diameter. The pipes were welded, but no stencil markings were in evidence to denote the type of stainless steel, specification, or source of manufacture.

The second system looked at, involved piping in Loop A of the Core Spray System. This loop is located inside the drywell near Valve V-20-17. Both welded and seamless pipe were observed with the seamless pipe bearing the following stencil notation:

"A-312; HT-2000
A-376 Type 316
Sulfate A-233"

A piece of pipe, approximately 5 feet long, downstream of the check valve was clearly welded, but we were not able to get close enough to determine whether filler metal was used in the weld.

Note

A subsequent review of weld records revealed that this material was supposed to be type 316 stainless steel (welded, ASTM A-312)

Work continued on March 20, as follows:

Next examined was 8" piping located in loop B of the Core Spray System. This piping was part of the system in the vicinity of the redundant isolation valves just outside the containment structure. (i.e.) Valve No. V-20-21and Valve No. V-20-41. Several sections of welded pipe were discovered in this loop. The weld seams were ground smooth with no clear evidence of weld beads and ripples. The pipe bore the stencil Marking, "Alloy Tube and Pipe Corp.)" Code ----".

Pipe in the Isolation Condenser System was Next Examined

Two pieces of pipe were examined. The first, a 10" diameter stainless steel pipe, approximately 5 feet in length showed clear evidence of being welded with filler metal. Weld beads and ripples were clearly in evidence as the weld surface had not been ground. The pipe had the notation N2.13 marked on them and a notation "YORK" stencilled upon it.

The second pipe in this system was an 8" diameter stainless steel with a designation NZ 2.14 marked on it. Also stencilled on the pipe was the following:

"Welded A-312 A&P Pipe TAG Job 608800 REG T1996,
Alloy Tube Pipe Corp."

Both of the above pipes were in one of the two isolation condenser return lines. The precise loop could not be ascertained.

On 3/21/69, pipe in the Core Spray System outside of the dry well was examined.

An 8" diameter stainless steel pipe, approximately 14 inches in length, was located upstream from Valve No. 20-15. This pipe was marked PS-27 and also NZ 2.3.8. Examination revealed that the pipe was welded with filler metal. A top layer of the weld deposit had been ground, but a lower layer had not been machined, and weld beads and ripples were in evidence.

The next system looked at was the Cleanup Demineralizer System.

A large amount of 6 inch seamless stainless steel pipe was in evidence.

Most of this pipe bore stencil markings as follows, "Sandvik Stainless Steel (seamless) 3R60 ASTM 312 Type 316 L Schedule 80. Various Heat No's were in evidence.

Several short lengths of seamless stainless steel pipe were in the system. These bore the notation ASTM A-376, they were marked "ND-2-9.7;" but the manufacturer was not identified. Several 6 inch fittings, welded with filler metal were installed in this system near valve ND-16.

An examination was made of stainless steel in the scrap pile, however, this search did not reveal any pipe in the categories in which we were interested.

A 6" stainless steel pipe with a thickness schedule of 10 was found. This pipe manufactured to ASTM A-312 was welded without filler metal, and the difference in appearance from the welded pipe installed in the plant was quite noticeable. There were no weld beads and the weld surface had not been ground. Schedule 10 thickness is considered to be the maximum thickness for pipe capable of being welded without filler metal.

Following examination of the piping systems, a return was made to the General Electric Office, where an investigation of records was being conducted by CO personnel.

Mr. J. Flora, and Mr. A. Ryan, of the Compliance Group were present to assist in the investigation. They had previously interviewed personnel at Burns & Roe Company, and were completely briefed on the project. It was proposed that they review all the welding records of the various systems checked by Mr. Carlson and the writer. These included the Core Spray System, the Isolation Condenser System, the Demineralizer System and the Reactor Shutdown Coolant System.

Using isometric drawings of the various piping systems, they were able to accurately identify the sections of pipe and fittings that had been looked at. Weld records, radiographs of field welds, and the weld histories of shop welds were to be checked. They also planned to check on procurement documents, material certifications and any other record which would provide information on the history of fabrication and inspection of the pipe.

The first system investigated was the Core Spray System. The isometric drawings of this system revealed that the welded pipe which we had observed outside the drywell upstream from the Valve V-20-15 was welded into the system by Field Weld No. FW 5936. The radiograph of this weld clearly revealed part of the longitudinal seam in the pipe and provided verification that the weld was indeed a filler metal weld. The records, however, indicated that the pipe was an ASTM A-312 welded pipe, (i.e., without filler metal).

Several elbows were joined to the pipe sections which had been looked at, these were readily identified on the isometric drawings. Since radiographs had been taken of these Field Welds, it was concluded that this would be a means of determining the presence of filler metal in the pipe, as a portion of the longitudinal pipe seam would be revealed in the radiograph.

The following radiographics films of elbows and connecting pipes and valves were examined:

FW 5922
FW 5946
FW 5948 A

All of these radiographs revealed the presence of filler metal in the longitudinal seam of the pipes.

Investigation of the documents revealed that a considerable amount of pipe had been fabricated by the Alloy Tube and Pipe Corporation, P. O. Box 9429 Houston, Texas 77011.

This material had apparently been ordered by Tubeco, Inc. 123 Varick Avenue Brooklyn, New York, who than performed necessary machining and assembly operations, prior to delivering the pipe to Oyster Creek.

Enclosures (3) and (4) provide information on the welding procedure, and heat treatment employed.

A meeting was held on 3/21/69 with the following people present:

Mr. Louis Loeb, General Electric Company, Manager of Materials and Quality Services for Domestic Turnkey Projects

Mr. B. Lari, Burns & Roe, Incorporated, Manager of Quality Control

Mr. B. Avers, Manager Quality Control Jersey Central Power & Light Co.

Mr. Robert Carlson - CO Region IV

Mr. Alvin Ryan - CO Region I

Mr. Roy M. Gustafson, DRS

Mr. Flora indicated that he had visited Burns & Roe and had discussed the pipe situation with Mr. Lari.

Mr. Lari stated that in the summer of 1966, difficulty was experienced in obtaining seamless stainless steel pipe conforming to the requirements of ASTM A-312 or A-376. He indicated that a General Electric Criteria permitted the interchangeability of stainless steel pipe fabricated in accordance with ASTM A-312, ASTM A-376, or ASTM A-358, and stated that a letter from General Electric confirmed this.

Mr. Loeb stated that he had discussed this matter with G. E., San Jose, over the telephone, and they had read the letter to him. He indicated that the letter authorized the use of pipe manufactured from rolled and welded plate, in lieu of seamless ASTM A-312 and ASTM A-376. He indicated that it did not mention ASTM A-358.

Mr. Loeb and Mr. Lari admitted that there was a considerable amount of pipe with filler metal, conforming to ASTM A-358 in various pipe systems, in the reactor.

They were emphatic, however, in their statements that no ASTM A-312 with filler metal was in the system.

Mr. Lari when questioned as to what class of ASTM A-358 pipe was furnished, showed unfamiliarity with the classes. However, after being informed, he stated that Class I requiring 100% radiographic examination was specified.

The welding records revealed that the welded pipe fabricated by Alloy Tube and Pipe Corporation was designated as ASTM A-312.

Mr. Loeb stated that where such pipe was furnished, it was in fact ASTM A-358 Class I.

The material certifications on this pipe had not been obtained and the inspection procedures, (i.e., 100% radiographic inspection), could not be verified.

Conclusion

Examination of pipe used in various systems in the reactor clearly revealed that a large amount of pipe welded with filler metal is present. This material substitution was authorized by Mr. Guido Lari, Quality Control Manager of Burns & Roe, and the substitution was based on information in a letter dated October 10, 1966 received from General Electric Company, San Jose, California. Mr. Lari interpreted this letter as authorization for the use of ASTM A-358 pipe, in lieu of seamless pipe in accordance with ASTM A-312 or ASTM A-376.

The weld records revealed that the pipe manufactured by Alloy Tube & Pipe Corporation was welded with filler metal in accordance with procedures shown in enclosures (3) and (4). Nothing in the records examined to date has revealed that the pipes were radiographically inspected. Until such inspection has been verified, it must be assumed that the pipe is ASTM A-358, Class II pipe.

A considerable amount of seamless stainless steel pipe manufactured by Sandvik Steel Corporation, Sweden, was in evidence in the Clean-up Demineralizer system. The material certificates on this material had not been obtained. The stencil markings on the pipe clearly indicated that the pipe was furnished in accordance with ASTM A-312 (seamless) and ASTM A-376 (seamless) requirements.

Examination of radiographs of various pipes and fittings confirmed the visual observation that welded pipe with filler metal was installed in the reactor.

The allegations regarding qualifications of welders and the companies providing piping can best be verified by visiting the different companies and examining their records and procedures.

CO personnel from Region I plan to continue their investigation of records at Oyster Creek.

Roy M. Gustafson

Roy M. Gustafson
Materials & Metallurgy Branch
Division of Reactor Standards

Enclosures:
As stated

Enclosure 1

Allegations Re: OC Materials & Equipment

1. Piping was supplied for use in OC-1 that was designated ASTM A-312 F.M.

   Alleged by Cella and Kiebler (Pipeco) to Gural (N. J.).

   Our Question: Evidently some A-312 F.M. was used, at least in 10" diameter in the Core Spray System and Reactor Isolation System. (Telecon, 3/17, Carlson - Rees, JC) - If so, under what engineering authorization? See items 1 and 3 below.

2. All 6, 8, and 10" diameter pipe at OC-1 is rejectable because it is either underweight, or was made by the addition of filler metal.

   Alleged by Cella to Ryan and Tillou on 3/11/69.

   Our Question: Was the pipe to which filler metal was added (that used in the Core Spray and Reactor Isolation Systems) acceptable with regard to weight? Refer to No. 1 above, on filler metal question.

3. Six, eight and ten-inch diameter fittings at OC-1 are suspect because non-qualified welders were used, and no "final testing or OC on welding" was done.

   Alleged by Cella to Ryan and Tillou on 3/11/69.

   Our Questions: With reference to the fittings in the Core Spray and Reactor Isolation Condenser Systems, may we see welder qualifications for fittings and pipe (to be chosen by CO), and records that demonstrate those tests required by Code were conducted on the chosen fittings?

4. The firms that supplied A-312 F.M. material were neither qualified to manufacture it, nor distributors of any known qualified manufacturer.

   Alleged by Cella to Moseley on 2/28/69.

   Our Questions: Who supplied such pipe? Are they "qualified" manufacturers? Are they established distributors?

Enclosure 1

5. Material certificates were provided that were found inadequate, or were only supplied affadavits (instead of true mill certifications).

   Alleged by Cella to Moseley on 2/28/69.

   Our Questions: Does JC, GE or B&R have any knowledge of such certificates? If so, what is the current disposition of them? (These questions are directed specifically at Class I and Class II piping and valves). Suggested CO test: Trace Manufacturer's private identifying mark on several F.M. pipe lengths. (See Section 21. (a) of A-312).

6. A-312 seamless or welded pipe for OC-1, was substituted for B&R specified A-376 pipe.

   Alleged by Cella to Ryan and Tillou on 3/11/69.

   Our Question: Since B&R's procurement specs. seemingly use A-312 and A-376 on a "both acceptable" basis, is there any application at OC-1 where A-312 seamless or welded pipe would be unacceptable as a substitute for A-376 (for Class I and II systems)? If so, is there convincing evidence that A-376 was used?

7. Some used valves, the certifications of which were inappropriate, were used at OC-1.

   Alleged by Cella to Ryan and Tillou on 3/11/69.

   Our Questions: Were any used valves employed in the construction of Class I or II systems? If so, under what code provision were they certified? May we see the documentation related to their certification?

Enclosure 2

Excerpts from Burns & Roe Specification S-2299-60 C

Burns & Roe, Incorporated

Engineer & Contractors

Oradell, New Jersey

Specification S-22 99-60C dated August, 1966

Piping, Reactor Building - Phase I & II

Main Mechanical Equipment

Installation & Miscellaneous Equipment

Jersey Central Power & Light Company

Oyster Creek, New Jersey

General Electric Company

Atomic Power Equipment Department

San Jose, California

Enclosure 2

Excerpts from Burns & Roe Specifications S-2299-60C Piping Systems

2.3 A System Designations Nu-3, Nu-4

Fluid - Condensate water System Reactor Shutdown Cooling System, Pump Discharge side isolation valve to recirculation loop in dry well	Pressure 1250	Temperature°F 575

Fluid - Condensate Water

System - Reactor Shutdown Cooling System

Pump Suction Side
Recirculating loop to isolation valve

2. Pipe

Material: Seamless stainless steel, ASTM 312 or 376,
Grade TP 316
Thickness - Schedule 80

2.3B System Designation Nc-3, Nc-4

Fluid - water	Pressure psig	Temperature
System - Drive water pump discharge after filter	1610	400°F

Fluid Water

System - Drive water pump Discharge after valve within containment vessel	1510	400°F

2. Pipe

Material - Seamless Stainless steel ASTM 312 or A-376, TP 316
Schedule 80

Enclosure 2

2.3-C System Designations ND-1, 2, 3, 4, 9, 10, 12, NP-2, RHC-2

Fluid - Water	Pressure	Temperature
	1250 psig	575°F

ND-1 to ND-2
System Cleanup Demineralizer

NP-2

Fluid - water
System - Poison System Pump Discharge 1250 575

RHC-2

Fluid - Water
System - Reactor Head Cool Isolation Valve outside of containment to reactor head.

Pipe

Material - Seamless stainless steel ASTM 312, or A-376 TP 316
Thickness - Schedule 80

2.3-D System Designation: GN

Fluid - Nitrogen	Design Pressure	Temperature
System - Nitrogen changing for control rod hydraulic system	3000 psig	400°F

2. Pipe

Material - Seamless stainless steel ASTM 312 or A 376, TP 346
Thickness schedule 160

2.3-E System Designations ND-5, 7, 8, 13

SD-4
NP-1
NC-5

ND-5, 7, 8, 13 150 psig 250°F

Enclosure 2

Fluid - Water

System - Cleanup Demineralizer

SD-4

Fluid - Dilute Acid 150 psig 250°F

System - Cleanup Demineralizer

NP-1

Fluid - water
System - Poison System Pump Section

NC-5 Fluid Water

System - control rod drive hydrostatic system from breakdown orifice to 23" west of Col. J at reactor building

Pipe - Seamless stainless steel ASTM A-312 or A-376 or TP 416
Thickness - Schedule 40 for 10" IPS & Smaller Standard 3/8" for 12" and larger

2.3-F System Designation NV-1, 2, 3, 13

Water - PH 2-12

Suction for lab. drain tank pump

Material seamless stainless steel ASTM A-312 or A-376

Thickness schedule 40 for 10" IPS or smaller standard 3/8" for 12" IPS or larger.

System Design NN-3, 4, 8, 10

Fluid Demineralized Water

System - Fuel pool cool and fuller
Discharge from demineralizer

Pipe ASTM - B 241 alloy 6061 seamless aluinum thickness 40 for 10"

IPS a smaller standard 3/8" for 12" IPS and larger

System Designation Nu-1, Nu-2

Reactor Shutdown Coolant System outside of drywell

Enclosure 2

Pipe - Material ASTM A-106 Grace C -
seamless thickness schedule 80

II-67

2.4.L Marking

Each length of pipe and fitting, shall be legibly marked by stencilling with the manufacturers name or trademark, size, thickness, ASTM Specification No. grade designation, plate quality, class and supplementary test numbers (as necessary to completely identify the pipe or fitting), the piping system identification symbol, and the hydrostatic test pressure. Steel stamping shall not be permitted except for radiographic identification, and then only interrupted type non-stress stamps shall be used.

2.4N Workmanship

All material and workmanship to be first class in every respect.

All materials shall be in strict accordance with the specification and drawings. Substitutions will be allowed only where materials specified are unobtainable and then only with the written approval of the Engineer.

It is understood that substitute material suggested by the Sub-contractors will be equal at least to that originally specified for the service intended, and if the cost is lower, the saving is to be realized by the owner only.

General Electric Specification 21 A5411 Revision 0

CRS Hydraulic System

Size, Inches	Material	Schedule
1	stainless steel	80
3/4	carbon steel	160
3/4	stainless steel	80
1/2	carbon steel	160
1/2	stainless steel	80

Enclosure 2

Material
Pipe

5.1.1 Carbon steel ASTM A-106 Grade B

8.1.2 Stainless steel ASTM A-312 or 376
Grades TP 304 or 316

4.3.1 Primary Sensing Lines

4.3.1.3 Piping (2" and smaller)

For SS-1 Classification - Schedule 80
seamless stainless steel ASTM A-376
Grade TP 304

For SS-2 Classification
Schedule 40 welded stainless steel
ASTM A-376 Grade TP-304

4.3.1.3 Tubing (For Classification 1 & 2)
Stainless steel - seamless ASTM A-269
Type 304 fully annealed bright finish 0.065 "min. wall
thickness".

** Welded or seamless ASTM 312 or A-376 Grades TP 304 or TP 316

Enclosure 3

Excerpts from Alloy Tube & Pipe Corporation Letter
Dated July 31, 1967 to Tubeco Inc.

"----letter of welding procedures #5, Revision #1, dated 1-11-67. This procedure was used on pipe furnished on your order No. P 36873 D. For the Type 316 stainless on your order, we used Type 316 wire and Arco 5-4 flux.----------."

Sincerely yours,

Alloy Tube & Pipe Company
Signed William O. Strong
General Manager

Enclosure 4

Excerpts from Welding Procedure #5 Revision (1) Dated 1-1'-67

This procedure was attached as an enclosure to the letter indicated in the Alloy Tube & Pipe Company letter to Tube Company on 7/31/67 (See Enclosure 3).

"The welding procedure utilizes a combination of MIG and submerged arc process using a double V groove preparation.

The base metal was identified as A-240-63 Grade 321.

Welding Electrode (Bare -ASTM A-371-62

MIG Process - 1st pass inside - MIG

Torch Shield - Argon 1%

Undershield - None

Polarity - reverse

Submerged Arc Process

Current - direct

Polarity - reverse

Peening of weld not allowed

Interpass temperature not to exceed 350°F

Electrode diameter, voltage and operating data from established weld schedule.

Heat Treatment

Heat to 1950 + 25°F. Hold for one hour per inch of thickness with a minimum of thirty minutes.

Water Quench

See Heat Treating Procedures for details.