

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

REGION I

Report No. 50-322/79-24Docket No. 50-322License No. CPPR-95 Priority -- Category BLicensee: Long Island Lighting Company (LILCO)175 East Old Country RoadHicksville, New York 11801Facility Name: Shoreham Nuclear Power Station, Unit 1Investigation At: Shoreham, New YorkInvestigation Conducted: December 11, 1979 through March 19, 1980

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Investigation Summary:

Investigation from December 11, 1979 through March 19, 1980 (Investigation Report Number 50-322/79-24)

Areas Investigated: The investigation covered thirty (30) allegations related to construction irregularities at the Shoreham site. The allegations were made via court testimony, personal interviews, magazine articles and alleged phone calls by third parties to one of the known alleged. The investigation involved 410 man-hours on-site by three (3) NRC investigators and (5) NRC inspectors.

Results: Of the thirty (30) allegations investigated, none were found to be substantiated. During the course of the investigation, two (2) items of noncompliance were identified: (1. Infraction - failure to identify nonconformance, Paragraph D.2; 2. Infraction - improper weld rod requisition forms, Paragraph D.10)

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I. BACKGROUND

A. Reason for Investigation

The Nuclear Regulatory Commission (NRC), Office of Inspection and Enforcement, Region I, was first informed of potential construction irregularities at the Shoreham Nuclear Power Station (SNPS) on December 1, 1979 when the NRC's Resident Inspector at the Shoreham site was contacted by Mr. Leighton Chong, one of the defense attorney's for an individual charged with trespassing at the Shoreham site during an anti-nuclear demonstration in June of 1979. During the week of December 3 through 10, 1979 additional information concerning these irregularities was presented by Mr. Chong and Mr. John Hall, a local independent TV producer. In addition, testimony presented during the above referenced trial on December 6, 1979 and local newspaper coverage thereof on December 7, 1979 was also made available by the NRC's Public Affairs Office. Based on the information received, the NRC initiated an investigation into alleged construction irregularities at the Shoreham site on December 11, 1979.

B. Identification of Involved Organizations

1. LONG ISLAND LIGHTING COMPANY (LILCO)
175 East Old Country Road
Hicksville, New York 11801

An electric utility licensed by the NRC to construct a nuclear power plant under NRC Construction Permit No. CPPR-95. (Docket Number 50-322)

2. STONE AND WEBSTER ENGINEERING COMPANY (S&W)
245 Summer Street
P. O. Box 2325
Boston, Massachusetts 02107

A company contracted by the licensee to perform various construction management activities at the Shoreham site.

3. GENERAL ELECTRIC COMPANY (GE)
175 Curtner Avenue
San Jose, California 95125

A company contracted by the licensee to provide the nuclear steam supply system and related components at the Shoreham site.

4. GENERAL ELECTRIC COMPANY, I&SE DIVISION (GE)
777 West Putnam Avenue
P. O. Box 6850
Greenwich, Connecticut 06830

A company contracted by the licensee to provide the turbine generator and related components at the Shoreham site.

5. DRAVO CORPORATION (DRAVO)
Neville Island
Pittsburgh, Pennsylvania 15225

A company contracted by the licensee to perform various construction activities at the Shoreham site.

6. COURTER & COMPANY (COURTER)
317 West 13th Street
New York, New York 10014

A company contracted by the licensee to perform various construction activities at the Shoreham site.

7. L. K. COMSTOCK & CO. INC. (COMSTOCK/JACKSON)
155 East 44th Street
New York, New York 10017

A company contracted by the licensee to perform various construction activities at the Shoreham site.

8. REACTOR CONTROLS, INC. (RCI)
1245 South Winchester Boulevard
San Jose, California 95128

A company contracted by the licensee to perform various construction activities at the Shoreham site.

9. PROTECTIVE SPRAY PLASTICS, INC. (PSP)
1130 Crose Avenue
New York, New York 10472

A company contracted by the licensee to perform various construction activities at the Shoreham site.

10. REGOR CONSTRUCTION CO., INC. (REGOR)
P. O. Box F
East Northport, New York 11731

A company contracted by the licensee to perform various construction activities at the Shoreham site.

11. JOHN GRACE & COMPANY (GRACE)
34 Washington Parkway
Hicksville, New York 11801

A company contracted by the licensee to perform various construction activities at the Shoreham site.

12. C. P. BENNETT/F&G CO., INC. (C. P. BENNETT)
231 Russel Street
Brooklyn, New York 11222

A company contracted by the licensee to perform various construction activities at the Shoreham site.

13. KTA-TATOR ASSOCIATES (KTA-TATOR)
3020 Montour Street
Coraopolis, Pennsylvania 15108

A company contracted by the licensee to perform selected QA/QC activities at the Shoreham site.

II. SUMMARY OF FINDINGS

A. Allegations and Investigation Findings

This investigation involves allegations that were introduced by various methods by several individuals. The investigation was initiated on December 11, 1979 as a result of the testimony of two individuals testifying on behalf of the defendant in a trial related to trespassing charges incurred at the Shoreham site in June of 1979. On December 12, 1979 an allegation was received in connection with the Shoreham site from an unidentified alleged through a local shopkeeper. This allegation is described and numbered 1 below. On December 17, 1979, NRC investigators met with Witness A in the above referenced trial. Witness A's allegations are described and numbered 2 through 9 below. On December 17, 1979 NRC investigators met with Witness B in the above referenced trial. Witness B's allegations are described and numbered 10 through 18 below. On December 17, 1979, defense attorneys in above referenced trial presented NRC investigators with allegations from other witnesses who were not called to testify and who wished to remain anonymous. These allegations are described and numbered 19 through 21 below. On December 17, 1979, the defense attorneys also presented NRC investigators with allegations from a former boilermaker at the site. These allegations are described and numbered 22 through 25 below*. On January 9, 1980, NRC investigators met again with Witness A who presented three (3) additional allegations allegedly received by anonymous phone calls. These allegations are described and numbered 26 through 28 below. On February 26, 1980, NRC investigators met again with Witness B at his request at which time another allegation was introduced. This allegation is described and numbered 29 below. Throughout the initial investigation, defense attorneys reported that pressure was being applied by the licensee (LILCO) and/or related unions in order to prevent workers from coming forth to the NRC with information. This matter was covered as a separate allegation and numbered 30 below.

*Knowledge of the existence of these allegations was made known to the NRC Resident Inspector at the Shoreham site on or about December 12, 1979 and appeared, in part, in an article published in Seven Days, Volume III, No. 12, dated October 26, 1979.

Allegations

NOTE: The allegations listed below have been summarized for clarity. The actual allegations are cited in detail in Section III of this investigation report.

- 1.) Inspection of the N-11 steam lines revealed cracks which may require that the entire system be replaced.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.1)

- 2.) Following concrete placements for the Reactor Pedestal and Reactor Building Primary Containment Wall, heaters were not used as required for curing during the winter months of 1973-1974. Similar conditions were allowed to occur in the Radwaste Building during the winter months of 1974-75 and 1975-76.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.2)

- 3.) Following concrete placements for the Reactor Pedestal, Primary Containment Wall, and Radwaste Building, forms were improperly stripped on the day following concrete placement instead of the required seven (7) days.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.3)

- 4.) Following the stripping of concrete forms for the Reactor Pedestal and Primary Containment Wall, large cracks, honeycombing deep enough to expose the rebar and through-cracks were patched over with mortar prior to inspection by QC.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.4)

- 5.) Cadwelds for rebar in the concrete located in the Reactor Building were in some cases found to be loose with concrete poured over the loose cadwelds.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.5)

- 6.) Rubber waterstops between concrete layers in the Radwaste Building were not installed properly and sometimes omitted entirely.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.6)

- 7.) A carpenter was permitted to weld studs to embedment plates used for pipe supports in the North wall of the Radwaste Building even though he had failed the welding test seven (7) times.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.7)

- 8.) Threaded tie rods without sleeves used as form ties for the Reactor Pedestal were pulled from the concrete after it had set, leaving a void in the wall. In some cases, large amounts of concrete were pulled from the pedestal wall in this manner.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.8)

- 9.) Several through-cracks were observed in the Turbine Building wall that separate it from the Reactor Building.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.9)

- 10.) During the first three weeks of February 1979, several dissimilar metal welds were made with ER-308 and/or ER-316 weld rod instead of the required ER-309 weld rod because welders claimed that it was too cold to return to their foreman and have incorrect weld rod requisitions changed.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.10)

- 11.) In a covert attempt to use substandard materials, E-6018 electrodes were used rather than the required E-7018 electrodes.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.11)

- 12.) A large scale repair on the feedwater condenser jacket was performed by a Regor boilermaker instead of the usual Courter and Company steamfitter in order to avoid having the crack reported to Courter QA personnel which would have raised the issue as to the integrity of the entire jacket.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.12)

- 13.) Due to the improper estimation of the depth of the water table by LILCO, salt water is seeping through the Secondary Containment wall at the 8 foot level and around-the-clock efforts are being undertaken to pump the water out.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.13)

- 14.) Stone and Webster lost its general contractor duties when it repeatedly complained to LILCO about the incompetence and corrupt practices of its contractors, such as Regor and Courter, which LILCO insisted on using.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.14)

- 15.) In addition to seven (7) major failures of hydroflushes of the primary closed loop piping system, a gross failure on or about June 15, 1979 caused valves to pop and a section of pipe to be ejected 50 feet into the air. It was also alleged that the hydrostatic test of the system in September of 1979 could not have been valid since it occurred too soon after the gross failure in June 1979 to have permitted proper shutdown and repair.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.15)

- 16.) The outfall pipes for the circulating water systems have never been properly anchored and due to the tidal action in Long Island Sound, have shifted, broken and separated from the line itself.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.16)

- 17.) NDE technicians were not adequately qualified for the jobs they were performing.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.17)

- 18.) Large quantities of green dye used for dye penetrant testing were being discharged by LILCO without proper approval and are polluting Wading River with eelgrass.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.18)

- 19.) Supervision of trade workers is inadequate and being performed by unqualified individuals.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.19)

- 20.) Qualification and training of subcontractor personnel at the Shoreham site is inadequate.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.20)

- 21.) Workers painting the inside of the Reactor Primary Containment were not qualified and when discovered by the NRC, most workers were layed off but the substandard work was not inspected and allowed to remain. It was further alleged that the remaining workers completed the jobs and on one occasion worked a 30-hour shift on methedrine.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.21)

- 22.) Tube support sheets in the condenser box were so misaligned that titanium tubing which should fit loosely, was hammered into place resulting in damage severe enough to cause a tube to break with the possibility of a radioactive spill.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.22)

- 23.) Radiographic tests revealed that the longitudinal seam welds for the condenser box were improperly done and when opened for rework were found to contain dirt, rubbish and weld rod stubs.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.23)

- 24.) Misalignment of the condenser tube support sheets required re-welding so often that in some cases the "mother material" around the weld had to be cut out and replaced with a fresh substitute section.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.24)

- 25.) Welds to be inspected are pre-marked by QA in order that the best welders can be assigned to these jobs while other welds are made by lesser qualified welders and never inspected. This resulted in a degradation of the overall quality and resultant safety factors at the Shoreham site.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.25)

- 26.) Turbine foundation bolts were installed so far out of alignment that it was necessary to chop out the concrete around the bolts, heat the bolts and bend them into a "Z" shape in order to fit them to the foundation plates.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.26)

- 27.) When concrete was placed in a cold joint on the 63' level of the Reactor Primary Containment, a large amount of rubbish and trash was permitted to remain within the form and the concrete placed on top of it.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.27)

- 28.) Soil percolation testing results were falsified and test results withheld in LILCO's submission of this information to the NRC.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.28)

- 29.) Welder performance qualification records were postdated for welders who qualified after performing welds for which they had not been qualified.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.29)

- 30.) Pressure was applied to construction workers by LILCO, its subcontractors and/or related construction unions in order to prevent and/or discourage workers from coming forth to identify construction defects and/or irregularities to the NRC.

The NRC investigation found no evidence and/or information to substantiate this allegation. (Details, Paragraph D.30)

B. Items of Noncompliance

During the course of the investigation, two (2) items of noncompliance were identified related to concrete records and dissimilar metal welds. Item No. 1 was corrected prior to the completion of the investigation.

- 1.) (79-24-01) Contrary to Criterion XVI of Appendix B of 10 CFR 50, the licensee failed to identify the nonconformance of Concrete Placement RS-4-12 with respect to curing requirements and consequently failed to take appropriate corrective actions at the time. (Details, Paragraph D.2)
- 2.) (79-24-02) Contrary to Criterion V of Appendix B of 10 CFR 50, the licensee issued two (2) Weld Material Requisitions which indicated ER-308 weld material instead of the required ER-309. (Details, Paragraph D.10)

C. Management Meeting

A management meeting was held on March 19, 1980 with licensee representatives at the conclusion of the investigation in order to discuss the NRC's investigation findings. The following individuals were in attendance.

- L. Narrow, Reactor Inspector (NRC)
- J. C. Higgins, Sr. Resident Inspector (NRC)
- J. P. Novarro, Project Manager (LILCO)
- W. J. Museler, Assistant Project Manager (LILCO)
- T. F. Gerecke, QA Manager (LILCO)
- W. Hunt, Project Engineer for Construction (LILCO)
- J. M. Kelly, FQA Manager (LILCO)
- T. Arrington, FQC Superintendent (S&W)
- A. F. Earley, Attorney (Hunton and Williams)

III. DETAILS

A. Introduction

This investigation was initiated as a result of the NRC-Region I being informed of various alleged construction irregularities at the site of the Shoreham Nuclear Power Station (SNPS). The exact number of alleged could not be determined due to the manner in which the allegations were received, i.e., court testimony, personal interviews, magazine articles and alleged phone calls by third parties to one of the known alleged. The primary initiating event of the investigation was the testimony provided on December 6, 1979 by two (2) former construction workers at the Shoreham site who were defense witnesses for an individual charged with trespassing during an anti-nuclear rally at the Shoreham site in June of 1979.

B. Scope of Investigation

This investigation included an examination of pertinent documents and records at the Shoreham site and at the NRC Regional Office; interviews and contacts with several licensee and contractor personnel (present and former employees); observations by the investigators as well as independent testing as applicable by the NRC through an outside testing laboratory (The Franklin Research Center).

C. Persons Directly Interviewed and/or Contacted During the NRC Investigation

During the course of this investigation, representatives of various subcontractors at the Shoreham site were contacted in order to set up interviews with their employees. The subcontractors contacted have been delineated in Section I-B of this report. The principal licensee representatives were identified in Section II-C of this report.

Several licensee and subcontractor personnel, present and former workers, at the Shoreham site were interviewed by the NRC in investigating the allegations contained herein. In order to protect the identity of those individuals, alphabetic designations have been assigned to individuals noted within the context of the report only when such designations are required in order to differentiate between the statements of one or more of the individuals. Otherwise, descriptive designations (e.g. QC inspector, welder, etc.) are used.

Throughout the investigation, sources of information were not identified by name to persons being interviewed unless (a) such person was identified by another independent document or person other than the source or (b) the person being interviewed independently acknowledged the identity of the source to the NRC. All individuals interviewed were notified of the voluntary nature of the interview, the right to have another person of their choice present during the interview, and the confidentiality provisions of this investigation.

D. NRC Investigation Findings and Conclusions Related to the Allegations

1. Allegation No. 1

a. Allegation

A random visual inspection of the Main Steam Line System (N-11) revealed cracks which had to be repaired. No further inspections of the N-11 System have been undertaken, and it is alleged that there are many other cracks in the system. It was further alleged that the entire N-11 System may be unfit and may have to be repaired or replaced.

b. NRC Investigation Findings

NRC investigators identified the extent of the N-11 System referred to in the allegation by a review of all of the N-11 System isometric drawings, including a review of the history of the piping from the steel mill to site erection. QA documents on pipe irregularities were also reviewed as well as an inspection of the piping itself.

The subject piping is that piping which carries main steam from the isolation valve outside of Primary Containment to the Main Steam Stop Valves for the Turbine. This pipe is 24" O.D., 900 psig rated SA-106, Grade B seamless carbon steel material obtained for spool piece fabrication by DRAVO from U. S. Steel. The piping system was designed by S&W to ASME Section III, Class 2 requirements. The site welding was performed by COURTER with inspections by COURTER and S&W surveillance inspection groups.

The NRC noted that manufacturing linear surface indications are to be expected in pipe of this large a diameter and these indications were acknowledged along with acceptance and repair methods in Paragraph 20 of the material specifications for the pipe. ASME NC-2550, 2551 and 2558 also indicate the acceptance and repair methods for surface indications in this type of pipe. NDE surface examination is not required by the code.

The NRC noted that the O.D. of the pipe was visually examined during site fabrication, prior to the installation of required insulation material. A total of fifty eight (58) COURTER Deficiency Correction Orders (DCOs) were written describing the surface irregularities as linear indications. These documents were included into COURTER Nonconformance Reports (NRs) NR-466 and NR-466A. The disposition and correction of the problem was also documented in S&W Engineering and Design Coordination Report (E&DCR) F-18716 and F-22478. The NRC determined that the disposition was in accordance with SA-106 and NC-2250 code

requirements and included grinding to remove the vast majority of the surface indications and repair welding of some defects shown by ultrasonic testing (UT) to encroach on the minimum wall dimensions.

NRC investigators interviewed the cognizant engineer who had provided the disposition of E&DCR F-18716 and who was knowledgeable of E&DCR F-22478. The NRC also interviewed one of the COURTER welders who worked on the repair of the linear indications. Both individuals independently stated that the linear indications identified were not cracks, but rather those types of metal forming irregularities acknowledged in the material specification. The S&W engineer indicated that the steam lines were completely examined by visual methods and all linear indications were dispositioned without any difficulties being encountered.

An NRC investigator visually examined all N-11 piping not covered by insulation and found no signs of "linear indications" but a large number of ground out areas as expected from the DCOs. One complete steam line had been previously inspected by the NRC and this inspection was documented in NRC Inspection Report No. 50-322/78-03. No items of noncompliance were identified in this area.

The NRC determined that the "cracks" in the main steam line as reported in the allegation were in all probability a misinterpretation of the normally occurring seams and laps found in material of this kind and were not cracks, per se. The disposition of these visually observed linear indications more than satisfied the minimum code requirements and no other deficiencies were observed by the NRC in the N-11 System.

c. NRC Conclusion

The NRC found no evidence and/or information to substantiate this allegation.

2. Allegation No. 2

a. Allegation

Following concrete placements for the Reactor Pedestal and Reactor Building Primary Containment Wall during the winter months of 1973-1974, heaters used to maintain the required curing temperatures were either not used, or when used were permitted to go out for extended periods of time during the night shifts. It was also alleged that ice was allowed to form on the concrete, a condition noticed when workers arrived in the morning. It was also alleged that the same conditions were allowed to occur in the Radwaste Building during the winter months of 1974-75 and 1975-76.

b. NRC Investigation Findings

The NRC investigators reviewed applicable sections of S&W specifications and QC procedures, including American Concrete Insititute (ACI) standards referenced in these specifications. These, as well as other selected specifications, standards and procedures reviewed during this investigation are referenced as Exhibit A of this investigation report.

The documents reviewed established as a requirement for the winter curing of concrete that the temperature be maintained at 40° F or higher for mass concrete (pours in excess of 30" in thickness) and 45° F for other concrete placements (pours in excess of 8" in thickness). The time period for this temperature maintenance ranged from 2 to 3 days depending upon the concrete's exposure to the elements, with a maximum allowable drop of 20° F within 24 hours after the removal of heat.

The NRC investigators interviewed several LILCO site QA personnel, S&W QC personnel, S&W construction engineering and supervisory personnel as well as DRAVO craft and supervisory personnel, all of whom had been involved with concrete curing from 1973 through 1976. From a review of procedures, documentation and these interviews, the NRC was able to establish that the winter control of curing temperatures was accomplished in the following manner:

- Concrete placements were contained within temporary enclosures fabricated prior to placement of the concrete.
- Heaters within the enclosure were provided. These heaters were maintained within the enclosures by laborers assigned to each of the areas. In the case of the failure of a heater, it was either repaired immediately or replaced by spare heaters provided for this purpose. In the case of damage to the enclosure itself, supervisory personnel were notified immediately and crews were assembled to effect the repairs.
- Construction engineers took three (3) sets of temperature measurements, (a) outside ambient, (b) ambient within the enclosure and (c) concrete surface temperatures.* These temperatures were taken daily including weekends at not less than 6-hour intervals. In addition, the outside

*These surface temperatures were considered to be conservative since the actual bulk temperatures of the concrete pour would have been somewhat higher than the surface temperature due to the heat of hydration released during the curing process.

ambient temperature was obtained daily from a thermometer which indicated the maximum and minimum temperature experienced during that time period. The daily minimum concrete and outside ambient temperatures were recorded on specially designated Curing Reports. Construction engineers also stated that during extremely cold weather, additional temperature readings were frequently taken. Temperature readings below the minimum specified were reported to Field QC personnel.

- Field QC personnel performed periodic reviews of all curing records to assure that the temperatures of the concrete met curing specification requirements.
- Nonconforming conditions were written up on Nonconformance and Disposition (N&D) reports for evaluation and disposition by Engineering. Nonconforming temperatures reported by Construction Engineering personnel were also written up on N&D reports.

NRC investigators reviewed in detail over 150 written curing reports for the time period from 1973 through 1976. The areas of the pours included concrete placements in the Reactor Pedestal, the Reactor Building Primary and Secondary Walls and the Radwaste Building. During the course of this review, one (1) concrete placement in the Reactor Secondary Wall (RS-4-12) was identified with a recorded temperature of 38° F on December 3, 1974, the second day of curing. The NRC investigators reviewed in detail all N&D reports for 1973 through 1976 written for failure to maintain the required temperature during the curing period. Six (6) N&D reports were found in this regard but it was noted that Placement RS-4-12 had not been identified as nonconforming. The dispositions of the six (6) N&Ds identified required the removal of defective concrete if necessary and the testing of the concrete with a Windsor Probe in order to demonstrate that the compressive strength of the concrete conformed to the construction specification. The NRC identified no problems in the disposition of these six (6) N&Ds.

The NRC investigators noted, however, that the failure to identify the nonconformance of the RS-4-12 Placement with respect to curing requirements and the failure to take necessary corrective action was considered an item of noncompliance with respect to 10 CFR 50, Appendix B, Criterion XVI which states, in part, "Measures shall be established to assure that conditions adverse to quality such as...nonconformance are promptly identified and corrected." (79-24-01)

Prior to the completion of the investigation, the licensee reviewed the curing reports for all concrete placements made from November of 1973 through February of 1980 (2156 in number) under winter conditions (818 pours) and summer conditions (1338 pours). Eight (8) additional placements were identified where either (a) no temperature was indicated for a given day (b) temperatures were identified which did not meet specification. The lowest temperature recorded during the time periods of the referenced winter placements was 37° F. The referenced placements were identified on N&D No. 2877 and 2909 and Windsor Probe tests were performed and witnessed by Field QC. Two (2) tests of three (3) shots each were made on each placement. Calibration procedures and test results were reviewed by NRC investigators and no irregularities were noted. In each case, the average of three (3) shots showed the compressive strength of the placements in question to range from 5200 psi to 6900 psi, well in excess of the design strength of 3000 psi. The item of noncompliance was considered resolved and NRC investigators noted that the minor deviations identified would only retard the early strength developed by the concrete and not cause any permanent damage, a conclusion further verified by the Windsor Probe tests.

NRC investigators could find no instances where concrete had been exposed to freezing temperatures, a condition that would have been evident even after the fact as the freezing would cause the surface of the concrete to chip and flake away. Of all the individuals interviewed, none could remember any circumstances relating to freezing conditions on the concrete and/or forms. One laborer foreman stated "Occasionally one (heater) would fail but it would be repaired quickly. Laborers would be circulating constantly to check on the heaters." He also stated that in critical areas additional laborers were assigned over and above those making the rounds in order to keep the heaters in operation.

c. NRC Conclusion

Although the NRC identified isolated instances where heaters had failed, this condition was to be expected and was corrected by licensee contractors in a timely manner.

The NRC investigation found no evidence and/or information to substantiate this allegation.

3. Allegation No. 3

a. Allegation

Following concrete placements for the Reactor Pedestal and Reactor Primary Containment Wall as well as concrete placements in the Radwaste Building made from the end of 1973 through the

beginning of 1976, forms were improperly stripped on the day following the concrete placement instead of the required seven (7) days after placement.

b. NRC Investigation Findings

NRC investigators examined applicable S&W specifications and ACI standards as referenced in Exhibit A of this report. It was noted that under ordinary conditions, when form removal is not controlled by specification, wall forms may be removed within 12 to 24 hours following concrete placement. S&W specifications state that wall forms may be removed when the concrete has achieved a minimum compressive strength of 500 psi and that this strength should be achieved within one (1) day.

NRC investigators examined several records of the 24-hour tests of concrete cylinders of 3000 psi concrete. These tests indicated that a range of from 789 psi to 1497 psi and an average strength of 1173 psi had been achieved after 24 hours.

NRC investigators examined several curing reports and conducted interviews with several S&W QC, construction engineering and construction supervisory personnel, as well as DRAVO craft and supervisory personnel involved in the placement and stripping of formwork from 1973 through 1976. These records and interviews indicated that wall forms were removed after 24 hours and that this time period was closely monitored by QC and engineering personnel.

The NRC noted that there was no ACI requirement or specification requiring these forms to remain in place for seven (7) days, although on occasion, forms were kept on for periods in excess of the 24 hour requirement. This latter case was usually dictated by work or location requirements such as when forms could not be removed from the lower areas of the Reactor Pedestal due to space limitations in that area. Although various individuals noted that there might have existed some engineering request for this particular extended support, the NRC could not confirm that fact by any written engineering documentation. No irregularities were noted in this area.

The NRC noted that although the alleged claimed that the seven (7) day stripping requirement was part of his training as a carpenter's apprentice, no substantiation of this fact could be obtained in the interviews of various craft personnel. As noted earlier, the seven (7) day requirement did not exist.

c. NRC Conclusion

The NRC investigation found no evidence and/or information to substantiate this allegation.

4. Allegation No. 4

a. Allegation

Following the stripping of forms from concrete placements for the Reactor Pedestal and Primary Containment Wall, large cracks, honeycombing deep enough to expose the rebar and possible through-cracks (cracks appearing at the same azimuth location on both sides of the wall) were all patched over with mortar prior to inspection by QC. It was alleged that the patching was performed by laborers in order to complete the work before QC had an opportunity to inspect the concrete surfaces and the patch work was done improperly, covering the honeycomb or crack with a loose mortar mixture. It was further alleged that patching in this fashion was a common, almost daily practice during the time that the alleged worked on site from 1973 through 1976.

b. NRC Investigation Findings

NRC investigators examined applicable S&W specifications, ACI standards and procedures for the repair of concrete (see Exhibit A). The NRC also examined in detail all N&D reports of concrete related defects in the Reactor Support and Primary Containment Walls covering the period in question (1973 through 1976) and interviewed several S&W QC inspectors, construction engineers, construction supervisors as well as DRAVO craft and supervisory personnel involved in the stripping of concrete formwork and concrete repair.

All of the individuals interviewed were emphatic in stating that the concrete repairs could not have been performed by laborers. The NRC noted that repair work of this type was under the jurisdiction and contract of the cement finishers and that the assignment of this work to laborers, or any attempt on the part of laborers to perform this work, would in all probability have resulted in a jurisdictional dispute which in turn would have caused the job to be shut down by the involved unions. Although the NRC realized the possibility of these conditions and questioned the alleged if possibly he had meant the masons (cement finishers) instead of the laborers, the alleged insisted that it was the laborers and not the masons who had performed the unauthorized repairs.

S&W QC personnel informed the NRC that they were required to inspect all concrete surfaces after stripping and that they had all been given verbal instructions to perform the inspection within 24 hours after the forms had been removed. QC inspectors

stated that due to the nature of the repair work and mortar used, any attempt at an unauthorized repair would "stick out like a sore thumb" and lead the inspector to chip into the patch in order to determine if a significant problem existed. All personnel interviewed confirmed the repair of any honeycomb or cracks prior to QC inspection would have been obvious to anyone experienced in concrete work because of the difference in surface color and texture between the poured concrete and the patched area. This was later confirmed by NRC investigators as they examined various concrete pours throughout the plant.

Investigation of the aforementioned concrete related N&D reports indicated that a report had been written for any honeycomb which exposed rebar to one half of its diameter. A review of the disposition of the N&D reports indicated that they included a detailed repair procedure approved by Engineering. The repairs were inspected throughout by QC inspectors in order to insure the removal of all defective material down to sound concrete and subsequent repair in accordance with the specified repair procedure. Defects which did not expose the rebar within the concrete were considered to be surface defects and although not requiring a specific N&D report, were repaired under QC supervision in accordance with ACI-301 and utilizing a special concrete bonding agent.

The above repair requirements were confirmed by interviews with involved cement finishers who stated "(There was) no way that repair work could have been done without QC seeing it as soon as the forms were raised. QC would be all over it." Another cement finisher stated "We won't touch a thing until QC has looked at it. We never do any repair work on our own. QC watches everything, how the mortar is mixed, placed and set - everything."

The NRC also noted through its interviews of several involved personnel and related N&D reports that through-cracks were unlikely due to the amount of rebar and due to concrete pouring techniques. No through-cracks were identified at the Shoreham site in the areas examined.

c. NRC Conclusion

The NRC investigation found no evidence and/or information to substantiate this allegation.

5. Allegation No. 5

a. Allegation

Cadwelds of the rebar in the concrete located in the Reactor Building were never x-rayed and were in some cases found by the allegor to be loose. It was further alleged that several loose cadwelds were found in the Reactor Building Outer Wall (Secondary Containment).

b. NRC Investigation Findings

NRC investigators examined applicable S&W specifications, General Procedures and QC procedures for cadwelding (see Exhibit A). These documents require that a specific number be assigned to each cadweld and this number is stamped on the sleeve of the individual cadweld. Each cadweld is subsequently inspected by QC and marked to identify it as either satisfactory or unsatisfactory and the sleeve number, welders symbol and result of the final inspection are marked on a Cadweld Control Record. In addition to the inspection of completed cadwelds, QC is required to monitor in-process cadwelding activities on a random basis. The location of all cadweld splices are noted on drawings by Field QC and these drawings are maintained in the QC file. NRC investigators noted no irregularities or deficiencies in these areas.

NRC investigators interviewed QC inspectors who had performed inspections of cadwelding during 1973 through 1976. It was noted that each individual interviewed stated independently that they had inspected each completed cadweld in addition to performing several in-process inspections on a random selection of cadwelds throughout the time period in questions. The NRC noted that problems identified were infrequent and when identified were corrected in accordance with accepted procedures. The NRC also noted that although no x-rays of cadwelding was required, the integrity of the cadwelds could be determined satisfactorily by mechanical and visual means. The NRC also determined that the control, inspection and documentation procedures made it unlikely that a loose cadweld would have been missed.

General Procedure W-300 provides for protective measures to be taken if cadwelding which is in-process cannot be completed by the end of the shift. At first, it appeared that perhaps the allegor may have observed a partially completed cadweld left for completion on the next shift and assumed that it had been completed and accepted. This assumption had to be discounted as a possible explanation for the allegor's observation since it was determined that such occasions were infrequent and the cadweld would have been wrapped in plastic clearly identifying it as "in-process" and incomplete.

c. NRC Conclusion

The NRC found no evidence and/or information to substantiate this allegation.

6. Allegation No. 6

a. Allegation

Rubber water stops between concrete layers in the Radwaste Building were not installed properly (not sealed or nailed to keys) and sometimes omitted entirely.

b. NRC Investigation Findings

NRC investigators examined applicable S&W specifications, and procedures for preplacement inspections i.e., inspections performed prior to the placing of concrete (see Exhibit A). These documents require that prior to release for concrete placement, the Field QC inspector shall complete the preplacement inspection portion of the Field Data Sheet and sign the "Release for Pour" block of the Concrete Pour Card. The "Preplacement Inspection" portion of the Field Data Sheet includes waterstop installation as one of the items to be inspected.

NRC investigators examined several Field Data Sheets and Concrete Pour Cards for Radwaste Building concrete placements for 1973 through 1976, the period of employment of the alleged. The NRC identified no deficiencies or irregularities in this area as all waterstop inspections had been performed as required and the pour cards had been properly signed by QC.

In order to confirm these findings, NRC investigators interviewed several S&W QC inspectors, construction engineers and construction supervisors, as well as DRAVO craft personnel and supervisors. All of the individuals interviewed had been directly involved in the installation, supervision of installation and inspection of waterstops in the Radwaste Building. The NRC noted that none of the individuals interviewed could recall any problem with the installation of waterstops. Craft personnel described the method of sealing the joints as well as methods of holding the waterstops in position using wooden blocks and wedges. These individuals also denied the use of any nails for attaching waterstops. The NRC also noted that training had been given in this area prohibiting the use of nails. QC personnel stated that the waterstop installation for each concrete placement was checked against the appropriate construction drawings as part of the preplacement inspection in the same manner as other embedments. The NRC noted that several craft individuals expressed mixed frustrations at times because of the several QC

inspections which had to be performed as the overall concrete placement operation progressed. None of the individuals, however, reported any irregularities in these operations whether they pertained to water stops or other involved inspection criteria.

c. NRC Conclusion

The NRC found no evidence and/or information to substantiate this allegation.

7. Allegation No. 7

a. Allegation

The allegor stated that as a carpenter he had been permitted to weld studs to embedment plates used for pipe supports located in the North wall of the Radwaste Building. It is further alleged that the welding was allowed even though the allegor had failed to pass the welding qualification test seven (7) times. The allegor also stated that the work was ordered by a carpenter foreman who provided him (the allegor) with the needed welding rod.

b. NRC Investigation Findings

NRC investigators examined the construction drawings (FC-25F-6 and FC-25K-6) which show the wall elevations and details of the Radwaste Building in the area described by the allegor. Drawing FC-25F-6 depicts the "V" line wall as the North wall. The NRC noted that the drawings do not specify any embedment plates to be located in the North wall.

NRC investigators visually examined the North wall of the Radwaste Building and all adjacent walls and surrounding areas and noted only three (3) locations where embedments were required, two (2) were for waste treatment equipment and one (1) was for a roll-up door. The NRC noted that there appeared to be no pipe support embedments on the North wall of the Radwaste Building. Further investigation of the Radwaste Building revealed that pipe support embedments were used very sparingly in the entire building and that most of the pipe supports in the Radwaste Building were of the concrete expansion anchor type.

The NRC investigators reviewed the quality assurance program in this area and noted that embedments were normally prefabricated in shops adjacent to the construction area. The embedments were made of structural shapes such as plates, channels or angles and manufactured studs were welded in rows to these shapes. The NRC noted that the welding was performed with a "gun" which secures the stud and welds it under controlled electrical conditions. These controlled electrical conditions provide a fairly uniform and repeatable weld. In contrast, a manually performed weld on studs of this relatively small diameter would be extremely difficult to make in a uniform manner even by an experienced welder much less by an individual who could not pass the welding test.

The NRC noted that the quality assurance program not only limited the number of people authorized to perform this welding but also limited the number of people authorized to receive welding rod and to sign the welding rod withdrawal form. From the standpoint of welder qualification, a review of all applicable records and interviews with several DRAVO craft and supervisory personnel indicated that (a) the number of qualified carpenter/welders was very limited,* (b) very few carpenters were ever selected to take the test and (c) an individual could only fail the test twice, for if he could not pass it on the second attempt, he was not allowed to take the test again. The NRC was also able to determine that the alleged was never selected to take the welders test and consequently could not have failed it one time much less seven (7) times as alleged.

From the standpoint of weld rod issue, the NRC noted that the quality assurance system closely controlled the issue of welding materials to qualified personnel only. The contractor involved in these areas had only four (4) individuals authorized by letter to sign welding material withdrawal slips. The issue of welding material was controlled by an independent group who, without proper authorization, would not issue welding materials. The NRC noted that the signature authorizing the withdrawal of welding materials must be authenticated. This was considered important due to the fact that the carpenter foreman who allegedly ordered the unauthorized welding and who allegedly provided the welding material was not authorized to withdraw the material.

*only thirteen (13) carpenters had been qualified in the past seven (7) years

The NRC noted, therefore, that in addition to the fact that there were no embedment plates used to hold pipes on the North wall of the Radwaste Building, the alleged was not selected to take the welding test, could not have failed it seven (7) times, would have had difficulty obtaining welding rod because he was unqualified and finally, determined that it was unlikely he received welding material from a foreman who was not authorized to sign weld rod withdrawal slips.

In order to further confirm the above findings, the NRC noted that the Radwaste Building was designated as a Seismic Category I structure, meaning that the quality assurance program applied for safety-related structures would require a "preplacement inspection" for every concrete placement performed. This item was documented on Field Data Sheets (Form T-S-31) and reviewed by the NRC. One of the attributes requiring quality control inspectors sign-off was "Embedments". The NRC interviewed five (5) of the original QC inspectors for the Radwaste Building who stated that all embedments were visually inspected for location, conformance to drawing details, and restraint to avoid movement during the actual placement of concrete. Although interviewed individually, all of the QC inspectors independently agreed that a manually welded embedment would be readily recognizable and would have been immediately questioned. To the best of their knowledge no manually welded embedments were ever noted.

c. NRC Conclusion

The NRC found no evidence and/or information to substantiate this allegation.

8. Allegation No. 8

a. Allegation

The alleged stated that threaded tie rods were used as form ties for the Reactor Pedestal along with she-bolts attached to the rods to hold the forms in place. It was further alleged that when the she-bolts were removed, in many cases the threaded rods would slide out of the concrete and a small patch would be put on the hole leaving a void in the center of the concrete. In some cases, it was alleged that when the she-bolts could not be removed at one end, the entire tie rod was pulled through the concrete pulling a large amount of concrete off the pedestal wall. It was alleged that rods were pulled through the concrete approximately twenty (20) to fifty (50) times in this fashion.

b. NRC Investigation Findings

NRC investigators examined several slides showing the actual concrete forms in various stages of installation for concrete placement for the Reactor Pedestal. The NRC also interviewed several QC and construction personnel in order to obtain information concerning the use of threaded bolts for form ties. The information obtained indicated that in general, standard manufactured (Williams) form ties and she-bolts were used. Although threaded rods and she-bolts may have been used in certain locations where the standard form ties did not fit the required configuration, interviews with the above referenced individuals could not determine these locations exactly. The NRC noted that either type of tie rod was acceptable, hence the matter was not pursued further.

The NRC also noted that the alleged's statement that the threaded rod would slide out of the concrete when the forms were stripped appeared to indicate that the rods were installed in sleeves, a fact which the alleged denied, stating that threaded rods not in sleeves were pulled from the concrete after the concrete had set. This was in apparent conflict with all of the individuals interviewed who stated that even when threaded rods were used, they were not in sleeves as the alleged stated but that they definitely remained in the concrete after the forms were stripped, in conflict with the alleged's statement.

The NRC did not attempt to pursue the matter further in order to resolve the conflict due to the fact that (a) either method of installation (with or without sleeves) was acceptable in the Reactor Pedestal and (b) if the rods were installed without sleeves as stated emphatically by the alleged, it would have been physically impossible to remove them from the concrete once it was set. The NRC determined that the alleged's statement that tie rods without sleeves were pulled out of the concrete could not be considered as credible. The NRC also noted that had sleeves been used, patching the holes would not have affected the structural integrity of the Reactor Pedestal, nor was the Reactor Pedestal designed to maintain airtight integrity.

c. NRC Conclusion

The NRC found no evidence and/or information to substantiate this allegation.

9. Allegation No. 9

a. Allegation

Several through-cracks were observed in the Turbine Building wall that separates it from the Reactor Building. It was further alleged that the cracks were so wide one could see through to the other side of the wall.

b. NRC Investigation Findings

The NRC noted that although the Turbine Building has a sheet metal roof and upper wall which are designed to blow off during a design basis tornado, the overall Turbine Building is not seismically designed nor is any credit taken for leak tightness. The design of the Turbine Building Ventilation System calls for it to exhaust air from lesser to progressively greater potentially contaminated areas to a monitored final exhaust. Thus even if a crack did exist, its significance would be minimal. The NRC noted further that there was no common wall between the Turbine Building and the Reactor Building so a crack in the Turbine Building wall would not mean a crack in the Reactor Building. In addition, any crack large enough to see through would be difficult to patch on any permanent basis without the crack opening up periodically.

On February 21, 1980, the NRC inspected the entire South wall of the Turbine Building, the wall facing the Reactor Building. Although several temporary openings were noted (openings scheduled to be closed at a later date), no significant cracks were identified.

c. NRC Conclusion

The NRC found no evidence and/or information to substantiate this allegation.

10. Allegation No. 10

a. Allegation

During the first three weeks of February 1979, welders were asking for ER-309 weld rod in lieu of the ER-308 and/or ER-316 weld rod specified on their weld rod requisitions for scheduled work on dissimilar metal welds. When refused by the weld rod clerk due to the improper designation on the weld rod requisition, the welders stated that it was too cold to return to have the requisition corrected to the required ER-309 and that the

ER-308 and/or ER-316 would be utilized in its place. It was alleged that these instances occurred two to three times each day during the three week period in February of 1979.

The systems alleged to have been involved were the Control Rod Drive System at Elevation 70' in the Reactor Building; the Flow and Pressure Instrumentation Lines in the T-48 Primary Control/Atmospheric Control System, the G-33 Reactor Water Clean-Up System; and the G-41 Fuel Pool Cooling System.

b. NRC Investigation Findings

NRC investigators reviewed in detail the flow diagrams of the four (4) alleged systems involved in the allegation as well as seven (7) additional systems. These flow diagrams depict material specification changes and pipe line numbers which can be traced to a specific weld. This review identified (12) dissimilar metal welds. The document packages for each of these welds were examined to verify that ER-309 weld rod was, in fact, used to make the specified welds. The result of this examination revealed that one of the welds (Weld Joint Number 1G-33-WD9-3-1-FW "D") was welded on May 19, 1979 using ER-308 material. No utilization of ER-316 was identified during this review.

The licensee was informed that 10 CFR 50, Appendix B, Criterion V requires in part, that "Activities affecting quality...shall be accomplished in accordance with these instructions, procedures, or drawings". The COURTER and CO. Welding Procedure Specification NW-100-01-08011AA, Revision 0, specifies that the filler metal for this weld be AWS Class ER-309. Contrary to the foregoing, Weld Material Requisition No. 55780 was issued to weld joint 1G-33-WD9-3-1-FW "D" specifying ER-308 material. This was considered an item of noncompliance (79-24-02).

Based on this finding, two (2) separate and distinct reviews were initiated by both the NRC and the licensee. All Category I piping isometric drawings were reviewed and all dissimilar metal welds were identified. In addition, all Task Engineering Component Checklists were checked and it was found that all dissimilar metal welds were listed. A cross check of these two sources of information indicated that all dissimilar metal welds had been identified. Four hundred and twenty two (422) dissimilar metal welds were identified and cross checked in this manner. The document packages for each of the 422 dissimilar metal welds were examined in order to verify that ER-309 material had been used as required. The results of this examination identified one additional weld (Weld Joint Number

M50-CW3-3-99) welded on April 12, 1979 that also had been welded utilizing ER-308 material. None of the dissimilar metal welds were identified as involving ER-316 material.

As an independent verification of the above findings, and due to the fact that ER-308 material was found in two (2) of the 422 welds examined, NRC investigators listed all of the identifiable ER-308 weld rod issues for the month of February 1979 from the weld rod control log. This log listed the date and use for each weld rod issue. The weld rod issues were cross referenced against the appropriate piping isometric drawing which would identify any dissimilar metal welds. Even if the pipe line did not represent a dissimilar metal weld joint, on isometric drawings which show more than one pipe line number, any dissimilar metal weld depicted on the drawing was examined in order to verify that ER-309 was in fact used. This independent verification of over six hundred (600) log entries dispositioned indicated no further discrepancies. Independent cross checks were also made by the NRC investigators on the completeness of the dissimilar weld testing and no discrepancies were identified in this area.

NRC investigators interviewed all available principals involved in the above referenced item of noncompliance. Interviewees included the Assistant Construction Manager, the welders who made the welds, involved weld rod checks, welding supervisors, area supervisors, assistant area supervisors and deputy foremen. As a result of these interviews, the NRC was able to determine that the misuse of ER-308 weld rod materials were relatively isolated occurrences rather than any significant breakdown in the licensee's construction QC program. The problem appeared to stem from paperwork errors related to the similarity of procedure numbers (08011AA for ER-309 and 0811AA for ER-308) and not a deliberate attempt by the welder to utilize the improper weld rod.

The two welds in question were cut from the system in the presence of the NRC on March 4 and 5, 1980. The removed welds were bisected and analyzed independently by both the licensee and the NRC to confirm the composition of the weld rod material contained therein. By chemical analysis, performed at the Franklin Research Center, the NRC determined that the weld material was in fact ER-308. Similar results were obtained by the licensee using spectrographic and chemical analyses.

The NRC determined that all welding performed on the control rod drive mechanisms was performed by Reactor Controls, Inc. (RCI) which maintained its own weld rod issue facilities,

totally separate from weld rod issues of COURTER for whom the allegor was employed. It was impossible therefore for the allegor to have dispensed weld rod utilized for the control rod drive mechanism. This system was included nonetheless in the NRC review and no irregularities were noted.

NRC investigators noted that the identification of the two welds containing the improper weld material while constituting an item of noncompliance, did not substantiate the related allegation due to substantial differences in time frame, scope, causality and magnitude. The NRC also noted that the use of ER-308 in place of ER-309, while not in compliance with specifications, would not have a significant adverse affect on the structural integrity of the two welds in question, a conclusion confirmed by the Franklin Research Center which stated that both welds were sound and that they were deposited without excessive base metal dilution.

c. NRC Conclusion

The NRC found no evidence and/or information to substantiate this allegation.

11. Allegation No. 11

a. Allegation

Although taught that only E-7018 electrodes were to be used at the Shoreham site, E-6018 electrodes were issued to a single welder who continually drew weld wire separately from other welders. It was further alleged that the above practice was performed in order to covertly use substandard materials.

b. NRC Investigation Findings

NOTE: The NRC noted that the ASME Code, Section II C, SFA-5.1 does not list an E-6018 electrode. It was assumed that the allegor meant E-6010 electrodes which are listed in the ASME Code and are in common use within the industry.

The NRC conducted several interviews with S&W QC inspectors, construction supervisors, weld rod control supervisors and weld rod issue clerks. These interviews disclosed that the only E-6010 electrodes used at the Shoreham site were utilized in connection with the carbon dioxide fire system installed by the C. P. Bennett Company. The NRC noted that extremely rigid

controls had been imposed on the issue, use, handling and return of the E-6010 electrodes in order to assure that their use was limited only to this fire system. Each weld electrode issue was counted and verified by the rod issue clerk, the welder, a LILCO QC representative and a representative of C. P. Bennett. A similar procedure was followed when the unused weld electrode and weld electrode stubs (used electrode) were returned. A LILCO Work Directive (WD-PS-4894) directed the Bennett Company to hire "...one Quality Control Inspector. Inspector's sole responsibility will be to ensure that the E-6010 Series Welding Electrode is used exclusively on the CO₂ System pipe welding."

NRC investigators conducted an additional interview with the C. P. Bennett General Foreman in order to confirm the above referenced procedures. No discrepancies were noted. The General Foreman stated that possibly no more than two (2) 50 pound cans were used for the CO₂ System and that only three (3) employees were authorized to sign for the E-6010 electrode issue.

NRC investigators noted that the allegation was presented in such a manner as to indicate that the licensee was covertly attempting to introduce substandard material into the construction project. Coworkers of the alleged individual indicated that this was not credible since all involved individuals (including the alleged individual) were carefully informed that the strict procedure was required in order to comply with the increased QC requirement. In fact, one supervisor stated that the alleged individual was fully aware of the purpose of E-6010 electrode and he (alleged individual) complained that the procedures were too strict. The NRC did not pursue these conflicts further as it did not affect the evaluation of the validity of the allegation.

c. NRC Conclusion

The NRC found no evidence and/or information to substantiate this allegation.

12. Allegation No. 12

a. Allegation

A large scale repair of a 10 to 20 foot crack was performed on the feedwater condenser jacket by a REGOR boilermaker instead of the usual COURTER and CO. steamfitter in order to avoid having the crack reported to COURTER QA personnel which would have raised an issue as to the integrity of the entire jacket. It was also alleged that an exceedingly large quantity of weld electrodes had been drawn in order to effect this repair.

b. NRC Investigation Findings

NOTE: The NRC was informed by the allegor of the welder's symbol and the Weld Rod Requisition Number, which was 170376.

An NRC review of plant equipment disclosed that what was referred to as the "feedwater condenser" was in fact the Main Turbine Condenser. This condenser is located in the Turbine Building and parts are located at the 63 foot level where the alleged irregularity occurred. In reviewing the time period in question, the NRC noted that the condenser was hydrostatically tested and a leak was found on or about August 25-28, 1978. The leak was located in the general area of the interconnect between the condenser shells. Weld Rod Requisition Number 170376 was confirmed by the NRC to have been issued on August 29, 1978 to the welder identified by the allegor. The requisition was for 100 each, 3/32" diameter, E-7018 welding electrodes for "repair weld condenser."

The NRC review indicated that the 3/8" fillet weld on the interconnect had been leaking and approximately 10 linear feet of this weld had been removed in order to repair the leak. The NRC noted that there was no "crack" in the strict sense of the word. Due to the fact that the area which was leaking was inaccessible from the outside of the interconnect and that the exact location of the leak could not be pinpointed, the weld in the immediate area of the leak as well as additional weld material on either side was removed by air carbon arc gouging. It was noted that the removal of the weld by air carbon arc gouging would also remove some of the base material therefore adding to the volume of weld metal needed to replace the weld. The rewelding procedure would involve a minimum weld size from 1/2" to 5/8" instead of the original 3/8" fillet weld.

NRC investigators performed calculations in order to determine the number of 3/32" diameter welding rods needed to fill a 3/8" X 10 foot* weld groove. The NRC determined that the issuance of 100 each, 3/32" diameter electrodes was not excessive relative to the volume of weld deposited in the prepared grove.

*Includes the cutting and repair of various stiffners which had to be removed in order to gain access to the leaking area

The NRC noted that since REGOR was contractually responsible for the work on the condenser, they were assigned to perform the repair work and that the job would not have been assigned to COURTER in any event. The NRC noted no deficiencies and/or irregularities in the repair operation.

c. NRC Conclusion

The NRC found no evidence and/or information to substantiate this allegation.

13. Allegation No. 13

a. Allegation

Salt water is seeping through the Secondary Containment Wall at the 8' level and around-the-clock efforts are being undertaken to pump the water out. It was further alleged that the seepage occurred due to LILCO's improper estimation of the depth of the water table under the plant.

b. NRC Investigation Findings

NRC investigators questioned several individuals working at the Shoreham site concerning the allegation and were unable to obtain any confirmation that any seepage had occurred. The NRC reviewed construction descriptions of the various waterproofing methods and other means of preventing water seepage and determined that the possibility of seepage in this area was highly unlikely.

In order to confirm the above finding, the NRC personally examined the areas in question during high tide on January 31, 1980, a date where according to local marina owners, tides were expected to be their highest due to the full moon. The NRC noted that there was absolutely no indication of leakage or any signs (e.g., water marks) that seepage had occurred in the past. In fact, the NRC noted that dust accumulations in some parts of the 8' level floors of the Secondary Containment indicated that the area had not seen water for some time.

Interviews by the NRC of various LILCO personnel indicated that on infrequent occasions in the past that some water might have reached the 8' level from within containment due to leakage of the temporary drain system or leaks from various hydrotests above that level within the plant but that to the best of their knowledge, no through-wall seepage problems had occurred in this area.

Interviews by the NRC of various S&W construction personnel confirmed the above observations but added that a minor problem had been experienced in the past with rainwater leaking onto the 8' level floor through an unsealed spare penetration during periods of heavy and sustained rainfall. The water was not extensive and merely flowed to one of the several permanent sumps located on that level for such purposes. S&W personnel stated that when sump pumps were operated, the water from the sump was held up for chemical analysis and filtering prior to discharge to the storm drain system in accordance with EPA guidelines. The NRC Resident Inspector was present at this penetration during a recent heavy rainstorm and no leakage problems were identified. S&W representatives stated that when the pumps had to be operated, they were operated by a representative of the operating engineers' union in accordance with union agreements and this condition would in all probability remain in effect until the pumps were transferred from the construction to the start-up group at which time automatically operating systems would be employed.

From the standpoint of other pump operations, the NRC noted that pumps outside of Secondary Containment were merely pumping water from the temporary drain system within the building into exterior drains and no irregularities were observed with respect to this practice. The pumping operation was due to be gradually phased out as the permanent drains within the building were integrated into the overall drainage system. The NRC also noted that extensive pumping operations were undertaken when the concrete was initially poured several years ago but that this was part of the normal dewatering operations conducted during construction work of this kind and did not indicate any seepage or water leakage problems or problems with any codes or other requirements.

c. NRC Conclusion

The NRC found no evidence and/or information to substantiate this allegation.

14. Allegation No. 14

a. Allegation

Stone and Webster (S&W) lost its general contractor duties when it repeatedly complained to LILCO about the incompetence and corrupt practices of its contractors, such as COURTER and REGOR, which LILCO insisted on using. In August of 1978, S&W was relegated to design, drafting and general QA duties while a dummy corporation, UNICO, assumed QC duties, and COURTER QA personnel assumed the QA field inspection duties.

b. NRC Investigation Findings

NRC investigators examined the various changes in the management of the Shoreham project. Among the items reviewed was a memorandum dated March 8, 1977 which documented a meeting between representatives of LILCO, S&W and the ASME Subcommittee on Certification. The subject of the meeting was S&W's application for NA and NPT Certificates of Authorization which would have allowed S&W to perform ASME Code work at the Shoreham site. The ASME Subcommittee agreed to grant the Certificates of Authorization subject to certain conditions, among which was the transfer of the contract between LILCO and COURTER and CO. to a contract between S&W and COURTER and CO. This condition was prompted by the fact that the ASME required QC operations to be performed by the actual contractor and not the subcontractor.

NRC investigators were informed that at this time LILCO was considering changes in construction management, and in a memorandum dated August 11, 1977 recommended that LILCO assume the leading role in construction management with S&W retaining responsibility for engineering and quality assurance. As of September 12, 1977 LILCO did assume the leading role in construction management. This change was effected by having LILCO assume leadership of the joint S&W/LILCO unified construction team (UNICO) through the appointment of a LILCO Construction Manager reporting to a LILCO Project Manager rather than the S&W corporate construction organization. LILCO also increased its participation in the UNICO organization by the transfer of a number of qualified construction supervisors to Shoreham from other LILCO departments.

As part of this change, LILCO decided to retain the COURTER and CO. contract directly rather than transfer it to S&W. Since COURTER was now the contractor, the ASME would not allow S&W to perform the code work as either LILCO or COURTER had to obtain the ASME Certificate of Authorization. Therefore, COURTER was directed to obtain the ASME Certificate and in order to do so was given the responsibility for quality assurance for their work on site. The ASME transition date was January 1, 1978. The only reference to any changes occurring in August of 1978 was a memo dated August 28, 1978 where some duplication in the inspection of non-safety related mechanical equipment and insulation was corrected by transferring the responsibility from the Construction Inspection Program (CIP) and FQC to the CIP alone. There were no complaints involved in the memo, only non-safety related equipment was involved and the NRC determined that there was no problem or irregularity associated with the transfer.

The NRC noted that UNICO was formed prior to March of 1977. The change of QC functions from S&W to COURTER was occasioned primarily as a result of ASME requirements and not due to any actions by S&W and/or COURTER. NRC investigators also interviewed several individuals involved in the S&W QC and COURTER QC organizations and the referenced transition and were not able to identify irregularities or deficiencies, either past or present, resulting from this transfer of responsibility.

c. NRC Conclusion

The NRC found no evidence and/or information to substantiate this allegation.

15. Allegation No. 15

a. Allegation

At least seven (7) major failures of hydroflushes of the Primary Closed Loop Piping System have occurred and during the flushing of the system on June 15, 1979, a gross failure of the primary system occurred involving valves popping and a section of pipe being thrown fifty (50) feet into the air. It was also alleged that the hydrostatic test of the system in September of 1979 could not have been valid, since it occurred too soon after the gross failure in June of 1979 to have permitted proper shutdown and repair of the system.

b. NRC Investigation Findings

The NRC reviewed all possible primary system hydrotesting records and interviewed several involved personnel and could not identify any major failures of the Primary Closed Loop Piping System during the time period up through and including June of 1979. Examining the time frame around the alleged June 15, 1979 date, the NRC noted that on June 13, 1979, one minor incident was identified where during the flush of the Core Spray System, a temporary gasket in a bolted joint failed and sprayed water over a large area. There were no major failures in the system, no valves failed nor were pipes thrown into the air. This review was documented in NRC Inspection Report No. 50-322/79-20.

The NRC investigators noted that the primary system hydrostatic test was not conducted until September 21-22, 1979. The NRC reviewed all test procedures prior to the test, was present and witnessed the actual performance of this test, and independently

verified the acceptability of the test results. The NRC noted no gross failures and the details of the test were documented in NRC Inspection Report No. 50-322/79-15.

The NRC reviewed documents referred to them by the allegor and found them to be outdated copies of normal check off sheets for the hydrotests which he (the allegor) had taken off site prior to his termination in May of 1979. The NRC was unable to reconcile the allegor's claim of having seen the gross failure (June 1979) since he had terminated one month prior to its allegedly having occurred. The NRC was also unable to reconcile the allegor's statement that exclusive of repairs it would have taken 4 to 6 weeks to shut down from the alleged failed test due to the fact that the shutdown operation can be performed in a matter of hours or at most days, depending on the procedures utilized and the system involved.

c. NRC Conclusion

The NRC found no evidence and/or information to substantiate this allegation.

16. Allegation No. 16

a. Allegation

The diffuser (outfall) pipes for the circulating water system have never been properly anchored and due to the tidal action in Long Island Sound, have shifted, broken and separated from the line itself. It was further alleged that a LILCO QA map documented the separated pipe pieces located in the Sound.

b. NRC Investigation Findings

The NRC investigators noted that a similar allegation had been made by a contractor employee in 1978 and had been investigated by the NRC in October of 1978. The results of this former investigation are documented in NRC Inspection Report No. 50-322/78-16.

NRC investigators pursued this matter further and interviewed various individuals associated with the placement and securing of the Offshore Discharge and Diffuser Pipe System. The NRC was able to determine that the fiberglass pipe sections were placed on the floor of the Sound and then covered with a minimum of 3 feet of crushed stone (approximately 1.5" in size) and then covered with a layer of armour stone (6" to 2' in size). The NRC identified the fact that while the outfall was being placed, prior to securing the outermost sections with stone, storms caused various sections to work loose and suffer some

damage. A weekend storm of October 2-3, 1976 caused damage to four (4) sections of the outfall. This occurrence was covered in N&D Report No. 1000. Another storm from May 6 to 9, 1977 caused damage to two (2) sections of the outfall, one of which was replaced as documented in N&D Report No. 1253. In October of 1977 an underwater inspection of the outfall verified that it was secure but the inspection indicated minor damage to a diffuser, a condition repaired and documented in N&D Report No. 1466. The NRC identified no instance whereby secured sections of the outfall had broken loose and separated from the system.

In attempting to determine the validity of the allegation with respect to the map depicting the location of separated outfall pieces, the NRC determined that a map of the outfall was posted when the system was being placed and being secured by rock. The map and diagram indicated which sections had been covered with the various sized rock and the flags indicated the location of the barges containing the rock used to secure the pipes and not section of pipe which had broken loose.

c. NRC Conclusion

The NRC found no evidence and/or information to substantiate this allegation.

17. Allegation No. 17

a. Allegation

NDE technicians were not adequately qualified for the jobs they were performing.

b. NRC Investigation Findings*

NRC investigators examined prior NRC inspection reports for the Shoreham site for the years of 1977, 1978 and 1979. It was noted that from January 1977 through June 1979, NRC inspectors reviewed the qualification records and observed NDE technicians performing tests during eight (8) inspections. In addition, it was noted that during welding inspections, NRC inspectors frequently include the inspection of the performance of nondestructive tests and also review the results of these tests, observations that would not necessarily be reported unless nonconforming conditions were identified. The NRC evaluation indicated that no deficiencies in the qualifications or performance of NDE technicians were identified during any of the NRC inspections reviewed.

*Due to the fact that no specific NDE technicians were identified by the allegor, the NRC evaluated this allegation as it pertained in general to the overall construction operation.

During this particular investigation, NRC investigators examined a random selection of experience, training and qualification records of NDE technicians currently at the Shoreham site. This examination showed the men in question to have been adequately qualified for the level of performance for which they are certified and to a degree commensurate with their responsibilities.

c. NRC Conclusion

The NRC found no evidence and/or information to substantiate this allegation.

18. Allegation No. 18

a. Allegation

Large quantities of green dye used for dye penetrant testing were being discharged by LILCO without proper approval and that this green dye was visible on the "outake" canal and polluting Wading River shellfish.

b. NRC Investigation Findings

The NRC assumed that since there is no "outake" canal at the Shoreham site, that the alleger was infact referring to the intake canal. The NRC noted that LILCO had discharged green dye to the Sound and that this matter had been identified by the NRC and documented in NRC Inspection Report No. 50-322/78-16. During that inspection, the NRC inspector observed the green color of the water in the intake canal at the screen wall and at the storm drain discharge in the canal. The NRC requested identification of the substance and examination of the discharge permit provision which allowed the discharge. LILCO representatives identified the material as a fluorescent dye and identified the individual within the New York State Department of Environmental Conservation (NYS-DEC) with whom approvals had been coordinated. NRC environmental inspectors were notified and subsequent contacts with NYS-DEC verified their cognizance of the discharges and their acceptability.

NRC investigators examined the intake canal and adjacent shore-fronts on Long Island Sound, including the most susceptible areas of Wading River, and found no visible evidence of green dye.

c. NRC Conclusion

The NRC found no evidence and/or information to substantiate this allegation.

19. Allegation No. 19

a. Allegation

Supervision of trade workers is inadequate and being performed by unqualified individuals.

b. NRC Investigation Findings*

During the course of this investigation, several construction workers from various trades and crafts were interviewed privately by NRC investigators. During these interviews, selected workers were asked their opinion not only of their own supervisors but of other supervisors within their own craft. The NRC noted that the majority of workers believed their supervisors to be qualified for their positions and in general providing an adequate amount of supervision. Although some workers did not feel qualified or able to evaluate their supervisor's performance, they did state that they did not have any problems in this area at this time. The NRC noted further that even in areas where workers admitted to personal differences with their supervisors, they still acknowledged their supervisor's ability to meet his supervisory responsibility. A random evaluation by the NRC of various supervisor's qualification did not reveal any inadequacies.

In order to indirectly determine the adequacy of supervision on site independent of workers interviews, NRC investigators requested one of the contractors (COURTER) to provide an indication of the number supervisory and non-supervisory personnel currently at the Shoreham site in construction related work areas. The NRC noted that the information provided indicated that in the four construction areas reviewed (Radwaste, Reactor, Instrumentation and Auxiliary/Yard Area), a supervisory individual was provided for every 2.4 craft individuals. Supervisory personnel included Welding Department Supervisors, Deputy Foremen, Area Foremen, General Foremen, Assistant Area Supervisors and Area Supervisors. If COURTER QC personnel were included, there would be one (1) supervisor for every 1.9 workers. The NRC determined that this level of supervision appeared to be commensurate with the extent of construction activities being performed at the Shoreham site.

c. NRC Conclusion

The NRC found no evidence and/or information to substantiate this allegation.

*Due to the fact that no specific instances and/or individuals could be obtained from the allegers, the NRC determined the validity of the allegation as it pertained in general to the overall construction site.

20. Allegation No. 20

a. Allegation

Qualifications and training of subcontractor personnel at the Shoreham site is inadequate.

b. NRC Investigation Findings

During the course of the investigation, several subcontractor personnel were interviewed by the NRC. During the course of these interviews, individuals were informally questioned with respect to their job responsibilities and past experience as well as how various aspects of their particular jobs were performed. The NRC noted that the workers interviewed appeared to have a degree of knowledge (by experience and/or training) commensurate with the job responsibilities given them, noting also that this level of knowledge covered a wide area ranging from the novice apprentice to the experienced journeyman. Some workers noted frustration in not being able to perform their jobs as they were accustomed due to the several QC checks which were required and which would delay the job until the inspection was performed and proper standards were met. Although some workers admitted not knowing all the standards in detail, they stated that they had no problems in this area due to the fact that their supervisors and QC inspectors would handle these areas. The NRC found no instance where a job requiring a high degree of skill was performed by an individual not having the qualifications and skills commensurate with the job.

The NRC also interviewed several QC inspectors and supervisory personnel in a similar manner as described above and were able to determine that their knowledge of the appropriate standards and procedural requirements was also commensurate with their responsibilities. No irregularities or deficiencies were identified (see also Paragraph 17 of this section).

From the standpoint of the actual training of subcontractor personnel by their own crafts, the NRC did not review the actual apprenticeship program of the various crafts as this was outside the purview of the NRC's responsibility. The NRC did, however, review the training provided by the subcontractors to these individuals as it pertained to their activities and responsibilities at the Shoreham site. The NRC reviewed a memo by S&W to all subcontractors dated August 20, 1976 describing the implementation of a site-wide training program, separate

from other training requirements as described in the Field QC Manual. Each contractor was directed to provide a minimum three (3) hour orientation program and to ensure that each new employee attended the courses. The NRC selected the Orientation Manual for DRAVO and reviewed it in detail. No apparent deficiencies were noted. A check of an alphabetical listing of DRAVO employees reflected the fact that all onsite employees were recorded as having attending this particular training.

The NRC reviewed Orientation Manuals for other subcontractors and determined that the DRAVO Manual was generally reflective of all submitted manuals in terms of content and course design. The NRC also conducted a random inspection of several of the training records in various areas as given by various contractors. For example, from April 26, 1977 through May 31, 1977 a one (1) hour course was given several times on the installation and inspection of wedge type anchor bolts which were installed in concrete to secure various pipes and equipment. Approximately 660 workers were given this course over the time period stated above. Similar classes were noted in welding and other craft activities on site.

The NRC was able to determine, therefore, that based on personnel interviews and training records reviewed, that the training of subcontractor personnel appeared to be adequate for their duties at the Shoreham site.

c. NRC Conclusion

The NRC found no evidence and/or information to substantiate this allegation.

21. Allegation No. 21

a. Allegation

Workers who commenced the task of painting the inside of the Reactor Primary Containment were not qualified. It was further alleged that an NRC inspection of worker qualifications resulted in a majority of the workers being ordered off the job; however, the substandard work that had been done to that point was allowed to remain and was not inspected by the NRC inspector; the remaining workers were ordered to complete the task on overtime and on one occasion they worked a 30-hour shift while on methedrine.

b. NRC Investigation Findings

NRC investigators noted that painting specifications, procedures and records were reviewed, as well as an in-progress inspection performed, by an NRC inspector as documented in NRC Inspection Report No. 50-322/79-20. No items of noncompliance were identified by the NRC inspector and the performance of the work as well as the QC inspection associated with it were considered to be acceptable. NRC investigators also reviewed all NRC inspection reports for 1975 through 1979 and found no record of an NRC inspector questioning painters qualifications at any time during this period nor any report of painters being layed off as a result of the NRC having questioned their qualifications.

The NRC interviewed S&W construction and QC personnel responsible for painting as well as QC personnel working for KTA-TATOR Associates, the consultant responsible for the inspection of painting within the Suppression Pool*. The NRC noted that during July through November of 1978, the painting of the Suppression Pool required a large amount of overtime, with men working 12-hour shifts, 7 days a week, using two (2) shifts per day with a day off every two or three weeks. The NRC could not identify any 30-hour shifts worked at any time.

During this painting operation two (2) types of coating systems were utilized in the suppression pool, an epoxy (K&L) system above elevation 30 and an epoxy-phenolic (Plasite) system below that elevation. The NRC noted that painters were qualified separately for each system in accordance with a proposed ASTM qualification method. Qualification for the Plasite system was considerably more difficult because of the coating system itself as well as the use of a more complex qualification panel. A large number of painters who had qualified on the K&L system could not qualify on the Plasite system panel. As the work in other areas neared completion, the men who had qualified for both system were retained while other painters with lesser qualifications were layed off.

*the Suppression Pool is the lower portion of the Reactor Primary Containment

Individuals interviewed by the NRC stated that the most visible effect of the long hours was a decrease in productivity. They stated further that the effect on quality was not identifiable and the reject rate was little if any greater. The NRC noted that the requirements for inspection and testing before, during and after application were sufficient to identify any decrease in quality. During this investigation, NRC observation of in-progress painting showed no irregularities or deficiencies.

As mentioned earlier, 30-hour shifts could not be identified by NRC investigators. From the standpoint of the methedrine allegedly used during this shift, the NRC found no indications of drugs being used in this manner whether in the area of painting or other construction areas covered in other aspects of this investigation report. Although the NRC was informed that the labor problems engendered by the aforementioned layoffs may have initiated this allegation, this matter was not pursued inasmuch as problems were not identified with the painting operation itself.

c. NRC Conclusion

The NRC found no evidence and/or information to substantiate this allegation.

22. Allegation No. 22

a. Allegation

Tube support sheets in the condenser box were so misaligned that titanium tubing which is supposed to fit loosely through the support holes was often hammered or twisted to fit through the sheets. It was alleged further that the damage was extensive enough to cause a tube to break with the possibility of a radioactive spill.

b. NRC Investigation Findings

The NRC noted that the "condenser box" or Main Surface Condenser is not a safety-related unit, nor is it classified as an ASME Code Vessel as the shell side is under vacuum. The unit itself is pre-assembled without the tubes, disassembled for shipment to the site, where it is reassembled, welded and tubed. This particular condenser was designed and shop assembled by Ingersoll-Rand (IR) in accordance with S&W Specification SH 1-6 dated June 16, 1969 and revised on August 15, 1969 and February 27, 1970. The NRC noted that the original specification called for SB111, Alloy CA706 (Cu-Ni) tubes but that the design was modified to improve water-side corrosion resistance by employing ASTM:B338, Grade 2 welded titanium tubes.

The NRC noted further that at the time of the material change to the improved titanium tubes, assembly of the condenser was partially completed to the Cu-Ni design. Since the maximum unsupported span for the titanium tubes was approximately 20% less than for the Cu-Ni tubes, the total number of supports had to be increased by approximately 25%. Due to the fact that the original tube support plates had been installed, the decreased unsupported span was achieved by the installation of additional partial tube support plates between those already installed. S&W stated that such a procedure was a standard solution for a retubed or partially built unit. This was confirmed by the NRC.

The resultant tube support plate system was reported by S&W to contain approximately 60-70% more tube support plates than would normally be necessary for a completely new design with some tube support plates as close as 18 inches apart. The unit was also designed to accommodate the MAN in-service (brush type) cleaning system by extending the tubes a minimum of 3/8" beyond the tube sheets.

The NRC noted that the unit was reassembled and fabricated in accordance with S&W Specification SH1-223 with surveillance inspection recorded for nine (9) attributes on the "Condenser Tube Installation Inspection Checklist." The NRC noted further that the increased number and decreased span of the tube support plates was recognized early as potentially producing a tube insertion problem prior to the tubing of the unit. This fact was documented in meeting minutes on the subject "Erection of the Surface Condenser" dated November 13, 1975 with LILCO, S&W, IR and REGOR (the condenser erector) in attendance. It was recognized at this point that the tubes would be scratched during the tubing operation and a maximum 0.004" scratch was permitted. S&W indicated that the 0.004" was acceptable based on equivalency to the current SB338 NDE Calibration Standard (Paragraph 10.2.1.2) of 0.004" and the UT Calibration Standard in the tubing Purchase Order Specification SH1-299. As indicated in an S&W letter dated July 22, 1976, a series of calibration comparison scratches were prepared for use during tubing in order to be able to determine acceptable scratch depths.

The NRC noted that as anticipated, there was a tube insertion problem due to alignment difficulties. This fact was acknowledged in the "Condenser Tube Installation Inspection Checklist" review which indicated that tubes with scratches exceeding 0.004" were removed from the condenser and scrapped. A detailed examination of these records indicated that the A-2 section of

the condenser was the most difficult to tube. S&W stated that the unit was tubed from the outlet side and consequently the outlet tube ends extending into the water box for the A-2 section of the condenser were visually examined by NRC investigators. Only minor inconsequential nicks were found at the ends of these tubes. S&W stated that no tube ends had required reforming for the insertion of the closely fitting rolling tool, a further indication that the tube ends were not deformed during tubing. Tubes accessible for visual examination on the shell side of the A-2 section of the condenser were also visually inspected by the NRC investigators. Only minor scratches were observed and these appeared to be in the 0.002" dimensional range.

c. NRC Conclusion

The NRC found no evidence and/or information to substantiate this allegation insofar as the tube insertion problem had been anticipated and was performed in an acceptable manner without any significant damage to the tubes. The NRC noted that a tube failure would not normally result in a radioactive spill. The condenser is under vacuum, and a leak would result in water from Long Island Sound leaking into the condenser rather than radioactive water leaking out.

23. Allegation No. 23

a. Allegation

Radiographic tests revealed that the longitudinal seam welds for the condenser box were improperly done and when opened for reworking, it was found that the welds often contained dirt, rubbish and weld rod stubs. It was alleged further that these conditions were sometimes discovered when the condenser had to be cut open to correct misalignment problems.

b. NRC Investigation Findings

The NRC noted that the condenser is not part of any safety-related system and is not classified as an ASME Code Vessel as the shell side is under vacuum. The unit was reassembled on site by a LILCO constructor (REGOR) in accordance with S&W specifications and with S&W performing surveillance quality control. The specification requirement for nondestructive examination of the welds was for visual examination only.

The NRC was informed through discussions with the S&W engineer responsible for condenser fabrication that as a result of the Field QC questioning the achievement of full penetration welds, "information only" radiographic and ultrasonic examinations of the welds were performed. The results of these examinations confirmed the lack of full penetration welds. Field QC reported that the radiographic examination identified welding technique problems including indications of slag, porosity and lack of fusion, but showed no indication of foreign objects such as rubbish and weld rod stubs.

The NRC noted that an S&W letter (SNPS No. 3850) dated April 19, 1976 describes the welding deficiencies and S&W E&DCR No. F-5104, dated November 5, 1976 submits the welding nonconformances to Engineering for review. Resolution of the E&DCR required that all accessible welds be air carbon arc back gouged and back welded. Inaccessible welds were strengthened by the welding of a stiffener to the face of the weld in order to provide the equivalent weld strength. Conditions of this type were not found when misalignment problems were corrected although in certain instances arc back gouging and back welding were performed as part of the realignment of installed partial tube support plates. The NRC noted further that in the majority of cases involved, the orientation of the welds would have inhibited the inclusion of any foreign objects.

c. NRC Conclusion

The NRC found no evidence and/or information to substantiate this allegation.

24. Allegation No. 24

a. Allegation

Misalignment of the condenser tube support required rewelding so often that in some cases, the "mother material" around the weld had to be cut out and replaced with a fresh substitute section.

b. NRC Investigation Findings

The classification, fabrication and field assembly of the condenser have been described in Paragraph 22 of this section, together with the tubing changes and the installation of additional partial tube support plates. Discussions by the NRC with S&W personnel and a letter dated October 14, 1975 by Ingersoll-Rand (IR) the condenser fabricator to their site erection supervisor, established that the partial tube support

plates do not provide any structural support for the condenser box. These support plates are installed in order to mitigate the flow-induced vibration of the titanium condenser tubes.

The NRC noted that the partial tube support plates were cut into pieces at the shop, reassembled in the field and installed by welding them to support hangers which spanned the distance between the original tube support plates. The difficulty encountered in the tube insertion revealed some misalignment problems between the original tube support plates and the additional partial tube support plates. The partial tube support plates were then cut from the support hangers, recut into sections and reassembled in order to improve the alignment. In order to facilitate the reassembly of the partial tube support plates and its attachment to the support hangers, flat plates, similar to stiffener/backing straps were installed for ease of welding. The NRC noted that this practice is in accordance with standard practices for the industry.

The NRC concluded that it was the stiffener/backing strap-like plates that were mistaken as the "fresh substitute section" referred to in the allegation. The NRC noted no unusually large amount of rewelding associated with the realignment of the partial tube sheet support plates. The flat plates were installed to facilitate reinstallation, the work was approved by engineering and inspected.

c. NRC Conclusion

The NRC found no evidence and/or information to substantiate this allegation.

25. Allegation No. 25

a. Allegation

Welds are marked by quality control before welding in order that the best welders can be assigned to these jobs. This is done to assure that they pass examination. Other welds are made by lesser qualified workers and never inspected, implying a degradation in overall quality and resultant safety factors at the Shoreham site.

b. NRC Investigation Findings

The NRC noted that welds in safety-related systems are required by the NRC to meet varying levels of quality based on their importance to the safety of the reactor. These welds are

required to conform to the applicable codes and standards. For example, at the Shoreham site, all safety-related pipe welds must meet ASME III and ASME IX Codes. The reactor coolant pressure boundary must meet ASME III Code, Class 1 by the NRC regulatory requirement. Welds of lesser sensitivity are permitted to meet ASME III Code, Classes 2 and 3, again, based on their relative importance to safety.

The ASME III Code specifies what testing methods are to be used for each class of weld; surface examinations for Class 3, radiography for Class 2 and a combination of these for Class 1 welds. The execution of these welds is controlled by an approved Nuclear Quality Assurance Manual which directs the project engineer to predetermine the inspection requirements for each weld on the component checklist. These checklists are posted at each weld where work is being performed, providing an additional indication of the classification of the weld involved further insuring that the more sensitive welds receive appropriate attention as required.

The NRC noted that welders working on safety-related pipe are qualified to the ASME IX Code. This code only recognizes "qualified" or "unqualified" welders with no grading system within the "qualified" classification. The assignment of the more skilled welders to the higher classification of welds would mean that the best craftsmen are working on the more sensitive jobs, a process consistent with good practice and generally enhancing the safety of the general public.

The NRC observed that if the inspection requirements were performed on a random sampling basis rather than the system described above, then the activities as alluded to by the allegation might have the potential of affecting the overall quality of the job by alerting individuals to those safety-related welds to be "randomly selected". Since all safety-related welds are inspected, this concern is not justified.

c. NRC Conclusion

The NRC found no evidence and/or information to substantiate this allegation.

26. Allegation No. 26

- a. Turbine foundation bolts had been installed so far out of alignment that it was necessary to chop out concrete around the bolts, heat the bolts and bend them into a "Z" shape in order to fit them to the foundation plates.

b. NRC Investigation Findings

NRC investigators interviewed S&W construction personnel and GE Installation and Service Engineering Department (GE I&SE) employees who were responsible for the turbine installation. The NRC also examined relevant GE procedures for the setting of the foundation plates. These procedures require that 2½ to 3 inches at the surface of the concrete foundation be chipped out prior to setting of the foundation plates in order to permit packing of grout under the plates. GE representatives explained that the centerline of the turbine must be aligned within hundredths of an inch. In order to meet this requirement the bolts were installed within sleeves so that they are free to move within the sleeve once the concrete has set. This is a conventional method of setting anchor bolts.

The GE and S&W personnel who were responsible for establishing the alignment and for setting the foundation plates all stated that there had been no problem with the alignment of the bolts. The only problem encountered had been the cleaning out the space between the bolts and sleeves to permit adjusting the bolt location within the sleeve.

NRC investigators examined slides showing the actual chipping of the concrete in progress and the installation of the foundation plates. No significant alignment problems were identified in these slides. The NRC noted that the planned chipping away of 2½ to 3 inches of concrete was an extensive operation and may have created the impression of improper alignment which was responsible for this allegation. The chipping of the concrete was performed by laborers who would not be fully cognizant of the foundation plate installation procedure further leading to the misunderstanding.

c. NRC Conclusion

The NRC found no evidence and/or information to substantiate this allegation.

27. Allegation No. 27

a. Allegation

When concrete was placed in a cold joint on the 63' level of the Reactor Primary Containment, a large amount of rubbish and trash was permitted to remain within the form and the concrete placed on top of it.

b. NRC Investigation Findings

NRC investigators reviewed concrete inspection records and N&D reports of concrete placements within the reactor building. There were no records of any cold joints in the Reactor Containment Wall but N&D No. 594 identified a cold joint in the shield wall at the 63' level. A preplacement inspection of the area had been made and documented prior to the placement of additional concrete and no irregularities were noted.

The NRC questioned several S&W QC inspectors and construction engineers as well as DRAVO craft and supervisory personnel concerning a cold joint in the Reactor Primary Containment Wall. Some of the individuals questioned mentioned one or two cold joints, including the one in the shield wall but were unanimous in stating that there were no cold joints in the Primary Containment Wall at or near the 63' level.

The NRC noted that the requirements for preplacement inspections prior to the placing of concrete above a cold joint are the same as for any concrete placement. A review of preplacement records by the NRC and interviews with several S&W and craft personnel identified cleanliness as an item of major importance during preplacement inspections to the extent that craft personnel were frequently delayed in placing the concrete in order to satisfy QC cleanliness requirements. The NRC acknowledged that while it was probable that the alleged mistakenly identified the shield wall cold joint as being in the primary containment wall there was nothing to support his allegation with respect to the lack of cleanliness.

c. NRC Conclusion

The NRC found no evidence and/or information to substantiate this allegation.

28. Allegation No. 28

a. Allegation

Soil percolation test results were falsified and test results were withheld from LILCO's submission of this information to the NRC.

b. NRC Investigation Findings

Due to the nonspecificity of this allegation, the NRC examined two (2) areas which appeared to have been responsible for the allegation being made. With respect to the soil percolation

tests themselves, the NRC noted that these tests are utilized to size and locate septic systems and are not used with respect to any structural design considerations. The NRC interviewed LILCO representatives with knowledge of this area and noted that the installation of the Office and Service Building septic system coincided with investigations into the potential for soil liquifaction under the service water system. On one occasion during the soil liquifaction boring program, and subsequent to a heavy rainfall, the building service engineer asked the geotech engineer to take borings in the vicinity of the septic tanks to find out why they would not drain. Three (3) borings were taken and given to the building service engineer, but the logs/results of these borings were not included in the liquification information for the FSAR. The NRC determined that this request to withhold the nonrelated information might have been misconstrued as a willful attempt to withhold information from the NRC.

The other area evaluated by the NRC investigation was the soil liquifaction work itself. The NRC noted that this matter was covered in the licensee's FSAR (Section 2.5) and Appendices 2A, 2I, 2J, 2L and 2M thereof and basically involved tests to obtain additional information on the soil conditions in the vicinity of the various components making up the service water system in order to determine the liquifaction potential in the event of a design basis earthquake. The various components making up the service water system included the service water piping between the Reactor Building and the Screenwell, the Screenwell, the wingwalls adjacent to the Screenwell and the Intake Canal itself. During the investigation, the NRC investigators did not evaluate the results of these tests as this had already been performed by the NRC as part of the overall licensing process.

The NRC did note, however, that the licensee's response to Request 324.5 of the FSAR provided LILCO's response (March 1976) as to why test boring data had been changed from the PSAR results. The investigators noted further that the changes primarily appeared to be minor accidental omissions of data which occurred when unnecessary data was intentionally removed. The NRC investigators found no intentional attempt on the part of the licensee to withhold information from the NRC, although someone not familiar with the matter again may have misconstrued it as such.

c. NRC Conclusion

The NRC found no evidence and/or information to substantiate this allegation.

29. Allegation No. 29

a. Allegation

Welder performance qualification records were postdated for welders who qualified after performing welds for which they had not been qualified.

b. NRC Investigation Findings

NRC investigators reviewed 1300 COURTER and CO. Nonconformance Reports (NRs) for indications of welding by improperly qualified welders. One (1) NR was identified which showed welds performed by an unqualified welder. NR-837 dated May 22, 1979, stated that in accordance with the Procedure Qualification Test Method (PQTM), the welder was required to qualify to Performance Test (PT) C-1 in order to weld a P-8 to P-1 material socket fillet weld in accordance to Weld Procedure Specification (WPS) 08011AA. The NR was dispositioned to "accept as is" on June 11, 1979 since the welder was qualified to (PT) C-11 for welding P-8 to P-8 material. ASME Section IX, QW 310.5 permits a welder qualified to weld P-8 to P-8 to also weld P-8 to P-1. Since ASME Section IX is the authority for welder performance qualifications, this permitted the welder to be authorized to weld on the P-8 to P-1 joint in question. The exception to the PQTM was authorized as a specific case and the welder was not added to the list as having passed the (PT) C-1 test. The NRC identified no problem in the disposition of this NR.

NRC investigators also interviewed the UNICO individual responsible for maintaining the listing of qualified welders who stated most emphatically that there had not been any postdating of welder performance qualifications. Although stating that an authorized mechanism existed for post-qualifying a welder in accordance with an E&DCR*, that this mechanism had never been utilized at the Shoreham site and in any event would not involve postdating any existing records. To do so, she stated, would require (in accordance with QAP-7.2) postdating and signing authorizations on five separate documents prior to inclusion on the qualified welders list and then the postdating of the qualified welders list itself. The NRC noted that such actions would be easily noticed if attempted.

c. NRC Conclusion

The NRC found no evidence and/or information to support this allegation.

*This mechanism is different from the disposition of the Courter NR as described earlier. In this later case, the welder would have to be actually requalified on the weld type in question and if he could not be, the weld would be removed from the system and performed by a qualified welder.

30. Allegation No. 30

a. Allegation

Pressure was applied to construction workers by LILCO, its subcontractor and/or related construction unions in order to prevent and/or discourage workers from coming forth to identify construction defects and/or irregularities to the NRC.

b. NRC Findings

In order to determine the validity of the allegation, NRC investigators provided several pathways by which current or former construction workers could contact the NRC with information in this regard specifically (i.e., intimidation) or with respect to construction defects in general. The results of these efforts are reviewed below.

i) Public Notices

From January 3, 1980 through the end of the investigation on site on March 12, 1980 (a period of 70 days) notices were placed at several frequented locations at the Shoreham site. This fact was confirmed by the NRC Resident Inspector and NRC investigators on site throughout the course of the investigation. A sample of this notice has been attached as Exhibit B of this report. The notice provided a minimum of three (3) points of contact with the NRC, one of which was manned on a 24-hour basis. The 24-hour number was also made public via a local newspaper, covering therefore, off-site and/or former employees still remaining in the area. In each case, full confidentiality was offered and workers had the option to call anonymously with their concerns if they so desired.

During the 70 day period that this notice was published, the NRC received two (2) phone calls. One of the phone calls was from a construction worker at the site who stated that he had worked at other non-nuclear power plants and that by comparison, Shoreham was "over-designed" and "super-safe". The other caller was a member of the general public who had concerns about nuclear power in general and specifically Shoreham because he lived in the area of the plant. Although his concerns were addressed, he provided no information related to a construction defect at the Shoreham site.

ii) Interviews of Construction Workers On-Site

During the course of the investigation, several workers were interviewed. All of the workers were interviewed in private, some during the investigation of the other allegations, some specifically selected at random in order to determine the validity of this particular allegation.

In the latter case, site representatives for various major subcontractors on site were contacted by the NRC and asked to provide a list of all current employees to NRC investigators. The investigators then selected at random a sampling of carpenters, laborers, masons, welders, electricians, boilermakers, teamsters, millwrights, insulators, steamfitters, sheetmetal workers, weld rod control clerks and QC inspectors. Through the sampling process, shop stewards as well as workers were also selected. Each individual was (a) interviewed in private, (b) informed of confidentiality, (c) provided with information for a callback to the NRC if desired and (d) was allowed to express his concerns in any area (i.e., construction defects) in addition to the specific area of intimidation as stated in the allegation.

Every individual interviewed informed the NRC that none of the workers had been directly or indirectly intimidated by any individual, union, contractor or licensee, in an attempt to prevent them from coming forth to identify construction defects and/or irregularities to the NRC. Each individual further informed the NRC that they had neither observed nor heard of such actions being executed on any of their friends or other employees not directly questioned. The NRC did not receive any callbacks at other times from the individuals interviewed in this regard.

Several of the workers interviewed volunteered statements to the NRC to the contrary of this allegation stating that if anything, the opposite of the allegation was true. Some of the statements made are included as follows:

Steamfitter A stated: "We never took a shortcut. This is a Class A job. Our relationship with LILCO is good and they cooperate fully with our concerns."

Millwright A stated: "Our local is very conscientious with nuclear energy. This (RCI) is the most conscientious outfit I've worked for."

Boilermaker A stated: "The union would be very supportive of our complaints."

Boilermaker B stated: "We've done our job right to the specs."

Boilermaker C stated: "If we ever found a problem it would be taken care of. They (LILCO) check out everything."

Electrician A stated: "Just the opposite. Everyone is concerned with QC. I've seen some of the better workmanship in the trade on this site."

Electrician B stated: "I haven't seen any problems in 5 years."

Electrician C stated: "No threats whatsoever. They (union and contractors) promote safety, especially on a nuclear job."

Electrician D stated: "We are told to bring up safety-related issues. Everyone is doing a Class 1 job. We are all going to suffer if something happens (when the plant is operational) so we are all supersafe about our jobs."

Millwright D stated: "Just the opposite. We are all told to look for problems. I haven't seen any so I don't know how they'll handle it."

Boilermaker D stated: "I would go to the NRC without hesitation. I live in the area and I wouldn't want anything to go wrong."

Sheetmetal Worker A stated: "They (foreman) tell us to report everything suspicious to them. I wouldn't be afraid to speak up."

Sheetmetal Worker B stated: "The company here (LILCO) is far superior to any other company I've ever worked for."

Sheetmetal Worker C stated: "Noone is afraid to come forward. In my opinion the job is being done better than it has to be."

Sheetmetal Worker D stated: "Something like that (threats) would get around fast, therefore no way they would do it. This job is going slow because all the safety checks you have to go through."

Sheetmetal Worker F stated: "I'm a shop steward. We watch who we send out there because it is a nuclear job. If they don't want to give quality work, they won't be kept here. I'm a shop steward and I have no fear of coming forth to the NRC."

Carpenter B stated: "I never saw a better job in my life and I've been in concrete for 26 years."

Mason A stated: "This is one of the best built jobs I've worked on."

Mason B stated: "I've been encouraged to bring problems to management. There would be more white hats (QC, S&W, NRC) than we knew what to do with. The QC here is tough."

iii) Resident Inspector

NRC investigators were informed by the NRC Resident Inspector that during his entire assignment at the Shoreham site (from October 1, 1979) even prior to the initiation of the investigation, no workers at the site (licensee or contractor) had ever approached him with any form of problem relative to construction defects and/or pressure not to present their concerns to the NRC. The Resident Inspector stated that he had made several tours of the site during this time, not only during normal working hours, but also during off-hours, weekends and holidays, and that to date he had yet to be approached in this regard.

iv) Protective Agreement

Attorneys for various allegeders claimed that several other workers wished to present information on construction defects but would not do so without a formal protective agreement provided by the NRC in order to ensure their confidentiality. A draft of this agreement was presented by the attorneys to NRC investigators on December 17, 1979. This agreement was forwarded to NRC Headquarters for legal review and subsequently sent to the allegeders' attorneys for implementation. When no new workers came forth even with the protective agreement, the NRC investigators inquired as to the reason. The attorneys stated that they (attorneys) had decided not to risk the lives of these additional allegeders due to potential threats to their jobs and/or persons.

The NRC could not reconcile this statement insofar as it had noted in i), ii) and iii) above that no evidence of any threats whatsoever could be substantiated during this investigation.

c. NRC Conclusion

The NRC found no evidence and/or information that would substantiate this allegation.

IV. EXHIBITS

Exhibit A: Referenced Codes, Specifications and Procedures

ACI 301	Specifications for Structural Concrete for Buildings
ACI 306	Recommended Practice for Cold Weather Concrete
ACI 347	Recommended Practice fo Concrete Formwork
ASTM (Draft 14)	Proposed Manual of Coating Work for Light Water Nuclear Power Plant Primary Containment Facilities (Subcommittee D-01.43)
SH1-64	Specifications for Substructure Work
SH1-354	Specification for Concrete Work
SH1-228	Protective Coatings Within the Primary Reactor Con- tainment Structure
SH1-228.700	Procedure for Applying Protective Coatings Within the Suppression Chamber
W 300-Section A	General Procedure for Cadwelding of Reinforcing Steel
QC-10.3	Field Quality Control Procedure - Concrete Quality Control
QC-14.2	Field Quality Control Procedure - Cadwelding
QC1-10.3.012	Quality Control Instruction - FQC Preplacement Pour Card
QC1-10.3.013	Quality Control Instruction - Preplacement Inspection
QC1-14.2.001	Cadweld Data Analysis



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NOTICE

The U. S. Nuclear Regulatory Commission is conducting an investigation into alleged improper construction practices which may have been undertaken at the Shoreham site. Any worker having information concerning these allegations or other concerns is urged to contact the NRC (collect) at 215-337-5000. NRC investigators will be on site from February 11-15, 1980*and may be contacted through the NRC Resident Inspector (extension 83-221) or at the Holiday Inn at Riverhead, New York, (516-369-2200). The NRC will maintain the confidentiality of the source of any information received during this investigation and in any resultant reports.

*new notices were posted prior to each on-site visit and the appropriate dates inserted at this location