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

Report of Inspection
CO Report No. 50-275/69-7

Licensee: Pacific Gas & Electric Company
Construction Permit No. CPPR-39
Category A

Date of Inspection: September 16, 1969

Date of Previous Inspection: June 26 and 27, 1969

Inspected by: A. D. Johnson 10/10/69
A. D. Johnson
Reactor Inspector (In-charge)

J. L. Crews 10/10/69
J. L. Crews
Reactor Inspector

Reviewed by: G. S. Spencer 10/10/69
G. S. Spencer
Senior Reactor Inspector

Proprietary Information: None

SCOPE

Type of Facility: Pressurized Water Reactor

Power Level: 3250 Mwt

Location: Diablo Canyon, San Luis Obispo County, California

Type of Inspection: Routine - Announced

Accompanying Personnel: None

Scope of Inspection: The inspection effort included a review of (1) the construction organization and relationships between PG&E, the prime construction contractor and the several subcontractors, and (2) the currently developed QC procedures related to the construction of the containment building and other Class 1 civil structures.

SUMMARY

Safety Items - None

Nonconformance Items - None

Status of Previously Reported Problems - None

Other Significant Items -

1. Detailed quality control procedures have been formulated concerning construction of the containment building and other Class I structures. The procedures related to nonconforming components and/or material did not clearly delineate responsibilities and approval authority for final disposition. PG&E indicated additional consideration would be given to the adequacy of these procedures.

2. The initial placement of reinforcing steel for the containment base mat is scheduled to commence in early October. A labor dispute which delayed the start of construction activities for approximately six weeks has been settled.

Management Interview - At the conclusion of the visit, the inspectors met with Messrs. Kelly and Lindblad to review the scope and findings of the inspection effort. Mr. Kelly indicated that the items concerning clarification of approval authority for final disposition of nonconforming materials and complete documentation related to placement and curing controls for concrete would be given appropriate consideration to assure adequacy of the procedures.

DETAILS

A. Persons Contacted

D. V. Kelly	-	Project Engineer
J. O. Schuyler	-	Senior Mechanical Engineer
W. J. Lindblad	-	Mechanical Engineer
M. H. Chandler	-	Manager, Station Construction
R. S. Bain	-	Construction Superintendent
W. R. Hersey	-	Project Superintendent
L. H. Carr	-	Quality Assurance Engineer, General Construction Department
R. R. Friedrichs	-	Resident Civil Engineer
A. J. Plewes	-	Construction Engineer
K. A. Beede	-	Engineer, Department of Engineering Research
R. Mayers	-	Inspection Engineer
J. H. Searle	-	Senior Materials Inspector
J. L. Murin	-	Civil Engineer, Q-A
F. W. Brady	-	Civil Engineer, Q-A
J. Zipperer	-	Q-A Specialist, Engineering Department
W. N. Harris	-	Q-A Engineer, Guy F. Atkinson Company

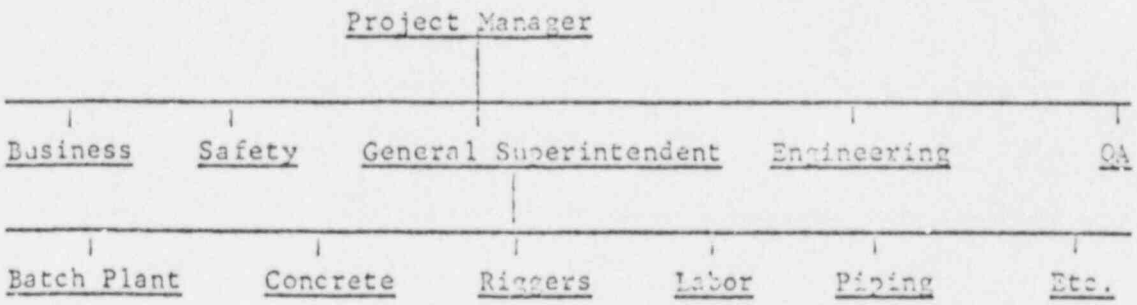
B. Concrete (Containment)

1. Implementation of Quality Assurance Program

Mr. Bain outlined the licensee-contractor line and quality control organizations for concrete manufacture, testing, placement and curing. The structure of PG&E's organization responsible for onsite supervision of contractor activities conforms to the organization table shown in Appendix B of CO Report No. 50-275/69-1. Mr. R. R. Friedrichs has been named the Resident Civil Engineer responsible to the Project Superintendent, Mr. Hersey, to assure that the contractors perform civil construction activities in accordance with the conditions of the contract.

Mr. Harris, representing the Guy F. Atkinson Company, explained that Atkinson will perform the concrete work; however, sub-contractors have been employed to install the reinforcing steel, embedded piping, tanks and containment liner.

Harris outlined Atkinson's onsite construction organization as follows:



Concerning the relationships of the licensee-contractor, Mr. Bain explained the duties of each as follows:

a. Atkinson is to manufacture, place and cure the concrete in accordance with the contract specifications.

b. Atkinson is to receive all concrete materials, assure that appropriate certification documents accompany all materials, confirm that materials as certified conform to the appropriate code requirements, and provide a copy of the documents along with material samples to PG&E representatives.

c. Atkinson is to prepare drawings of each concrete lift for PG&E's approval. These detailed "lift drawings" are to show the complete layout of the lift indicating dimensions, elevations, and location. Embedded items are to be shown such as anchor bolts, water stops and miscellaneous metals. The shop drawings will be used for placement of reinforcing steel, electrical conduit and piping. The lift drawings are to also show the class of concrete and all finishes. A "Bill of Material" listing all materials or equipment required for the lift is to be included on each drawing.

d. PG&E has the responsibility and authority to inspect all construction activities to assure contract conditions are being satisfied.

e. PG&E is responsible to obtain samples, test and evaluated results of materials used in the construction of the facility. PG&E is also responsible to sample and test the manufactured concrete to confirm that the manufactured product conforms to the contract specifications.

f. PG&E has the responsibility to inspect and verify that proper procedures are followed in placement and curing of the concrete as prescribed by the contract.

g. PG&E inspectors are responsible to thoroughly understand the requirements of the contract specifications and applicable standards or codes pertaining to the work in progress. An inspector also has the authority to stop or reject all work which in his opinion is below specified quality standards if Atkinson does not take proper action to document such deviations as well as initiate the proper corrective measures. Such items and activities are required to be noted on the inspector's daily report of activities to the Resident Civil Engineer.

2. Review of Quality Control System

a. Mix Design

According to Mr. Friedrichs, concrete trial batches containing various amounts of materials have been tested and evaluated in accordance with the standard ASTM procedures. To date sufficient data have been accumulated to enable selection and approval of an appropriate mix for 3,000 psi concrete (Class B). According to Mr. Beede, this mix design was determined in accordance with method 2 of ACI 318-63 section 502. However, the mix for 5,000 psi concrete (Class A) has not yet been approved. The Approved Class B mix design was stated to be as follows:

Strength - 3,000 psi in 28 days Slump - 3 inches

Ingredient	Weight - Pounds/cubic yard
Water	291
Cement	498
Sand	1,330
3/4-inch aggregate	820
1½-inch aggregate	890
Air entraining agent	(-) 2.5 fl. oz.
Water reducing agent	(- 42 fl. oz.

b. Temperature Limits

The contract specifications include appropriate limits concerning temperature and delivery time as reported in CO Report No. 50-275/69-6.

The batch plant is fully automated with its operation and batching cycle initiated by a mix card inserted into the control console. The card is checked by the PG&E batch plant inspector to assure that the proper mix is used for the concrete placement in progress. Each concrete mix will have an identifying number along with the design strength and the structure or structures for which its use is intended.

The plant is equipped with an automatic digital recorder which provides a record on tape of materials, time and temperature of the batch. The inspector is responsible for verifying that the manufactured concrete conforms to the contract requirements. PG&E's QC procedure also instructs the inspector at the placement point to confirm from the batch ticket that (1) the mix is proper for the location and (2) the age of the batch is less than 45 minutes. Mr. Friedrichs stated that in view of the closeness of the batch plant to the work area, the age of the concrete at time of pouring should average approximately 15 minutes. He also added that the ambient temperature in the area seldom drops below 35°F in the winter or rises above 90°F in the summer.

c. Slump, Strength and Air Entrainment Tests

The contract provides appropriate procedures and requirements concerning these tests as reported in CO Report No. 50-275/69-6.

PG&E's QC procedures include provisions establishing the frequency of tests and the standard ASTM procedures to be followed in performing and evaluating the tests. The procedures require test cylinders to be taken on a minimum frequency rate of 1 set for each 100 cubic yards of concrete manufactured. These cylinders of concrete are to be used to determine the strength characteristics of the concrete placed in the structures. The procedures also require that during the early stage of construction cylinders be cast at time of placement to provide data to correlate strength characteristics of the concrete as mixed at the plant and after transportation to the placement site.

Slump and air entrainment tests are to be performed in conjunction with the casting of all test cylinders. In addition, the procedures require additional checks of slump and entrainment between casting cylinders. Also, slump is to be checked by the laboratory personnel should the placement inspector observe variations in the concrete being placed.

Documentation of all concrete test results is to be made on approved forms. All tests are to be identified as to the structure, placement and batch number for future reference.

d. Curing Procedures

The contract requirements concerning curing of concrete have been documented in CO Report No. 50-276/69-6. PG&E's QC procedures designate the placement inspector as the responsible individual to confirm that Atkinson follows the appropriate procedures as prescribed in the contract specifications.

e. Placement Control

Both Atkinson's and PG&E's QC procedures require that prior to concrete placement, the particular area will be inspected by representatives of both PG&E and Atkinson. Each representative is to sign the placement card (checklist) indicating that the area has been inspected and approved. Items to be inspected and approved included: (1) cleanup, (2) line and grade, (3) forms and blockouts, (4) reinforcing steel, (5) inserts, (6) anchor bolts, (7) embedded metal (8) water stops, (9) joint filler (10) piping and (11) electrical. The inspector commented that the checklist contained no provisions for documenting confirmation that adequate personnel and equipment were available for the placement operation. Both Harris and Friedricks indicated these items would be added to the list along with a provision for the PG&E placement inspector to document the fact that proper curing procedures have been implemented subsequent to placement.

The procedure for insuring that proper concrete is delivered to the proper location in the time required is keyed to the batch ticket which contains a mix design number and the time the batch was manufactured. The placement inspector is responsible for verifying that the mix design number

is consistent with that shown on his lift drawing. He is also required to verify from the time shown on the ticket that the age of the concrete is less than 45 minutes prior to authorizing placement.

3. PG&E Inspector Qualifications

Provisions in the onsite quality assurance plan concerning qualification of inspectors require that:

a. A record of the job experience and training of each inspector working at the construction site shall be filed with the quality assurance records.

b. PG&E is to certify that the individuals are suitable for the assigned responsibilities.

c. The following requirements are to be used in selecting inspectors.

(1) BS degree or equivalent academic training in engineering or five years experience in construction practice.

(2) Thorough knowledge of applicable codes and specifications.

(3) Certificate from an organization which specializes in nondestructive testing training.

Mr. Chandler, Manager, Station Construction, stated that the inspectors will be drawn from organizations within the General Construction Department of the Company. He did not expect difficulty in filling the needed inspector positions from the 4,700 employees in the Department. He added that if sufficient qualified personnel were not available within the company, qualified personnel would be hired from other labor sources.

C. Reinforcing Steel (Containment)

Quality control procedures relating to the manufacture and placement of reinforcing steel were reviewed, and discussions were held with Messrs. Lindblad, Carr, Harris and Bain. The following information and observations resulted.

The G. F. Atkinson Company (Atkinson) has contracted with the Pacific States Steel Corporation (PSSC) of Union City, California, to supply and install reinforcing steel for the concrete structures of Diablo Canyon

(Unit 1) plant. The PSSC has retained the Pittsburgh Testing Laboratory (PTL) in Oakland, California, to provide quality assurance of both the manufacturing and fabrication (installation) activities of PSSC. The Atkinson Quality Assurance Manual contained procedures relating to the following quality assurance activities of the PTL.

1. Quality Control Organization

The PTL quality assurance personnel will be under the supervision of the PTL District Office in Oakland. The District Manager, Mr. R. F. Mikus, is to report to the Vice President, Mr. J. R. Deubert, of PSSC in Union City. An organization chart in the QA Manual showed the assignment, under Mr. Mikus, of three PTL inspectors at the PSSC mill and four inspectors at the Diablo Canyon site. A footnote on the chart stated that "The number of inspectors will be governed by workload requirements". Biographical data and the qualifications of each PTL inspector are to be provided to Atkinson, according to statements in the QA Manual.

2. Quality Control Procedures - Steel Manufacturing

Written procedures described the duties and responsibilities of PTL inspectors at the PSSC mill to include the following:

a. Determine the sequence of sampling of the steel for ladle and check analyses.

b. Observe laboratory procedures of steel analysis.

c. Review all chemical analysis results. (A PTL inspector is to sign the chemical analysis reports prepared by PSSC.)

d. Determine that proper identification and separation (by heat) is maintained of steel billets after stripping and rolling.

e. Verify the proper marking and identification of finished bars. (Each bar is to contain, in addition to that marking required by ASTM A615-68, the number of the heat from which it was rolled.)

f. Select bars and witness the cutting of samples from these for tensile and bend tests. (The PG&E contract specifications require bend tests on No. 14 and 18 bar. Such a requirement is not contained in the applicable ASTM specification, A615-68.)

g. Witness tensile and bend tests on each heat and bar size. (Sizes #3 through #11 are to be tested at the PSSC mill. Sizes #14 and #18 are to be tested at the PG&E Diablo Canyon Laboratory.) A PTL inspector will sign all physical test reports.

h. Verify that all testing results are in accordance with specifications prior to the shipment of any steel to the site.

3. Quality Control Procedures - Steel Fabrication and Installation at the Site

The QA Manual contained procedures relating to the following duties and responsibilities of PTL inspector at the Diablo site:

a. Check all steel shipments received at the site, and determine that they are properly identified and tagged. (Shipments are to be checked against production and delivery order.) Each shipment is to be inspected for damage in transit.

b. Check the placement of all steel, and verify (by heat number) the location of bars in accordance with detailing drawings.

c. Inspect all welded and Cadweld splices. (The location of each splice is to be recorded and compared to the detailing drawings.)

d. Conduct random inspections of the quality of deformations.

e. Verify proper spacing of reinforcing steel.

f. For each Cadweld splice the PTL inspector is to verify and record: The splice number, location (group, layer and run), pre-heat, setup for splice (alignment, centering and gap space), post-splice visual inspection, void area, splicing crew identification, and whether the splice was selected for tensile testing.

Cadweld splices are to be inspected in accordance with Erico Products, Inc., procedure dated August 1969. This procedure contains void limits for filler metal at the ends of splice sleeves, e.g., 2.64 square inches for No. 18 bar (splice Cat. No. RBT-1876 H). In response to the

inspector's inquiry, Mr. Carr said that void areas would be determined by probing the splice ends with a small diameter wire.

D. Containment Building Steel Liner

Fabrication and field erection of the containment building liner has been subcontracted by Atkinson to the Pittsburgh-Des Moines Steel Company (PDM).

The Atkinson QA Manual contained quality control procedures to be implemented by PDM. The procedures covered, in separate sections of the Manual, both shop fabrication and field fabrication and erection.

During the current inspection, principal attention was given to the field quality control procedures. The following information and observations resulted:

1. Quality Control Organization

An organization chart in the QA Manual showed a line of "authority and decision" extending, independent of production, from the PDM QA Chief at the site to the PDM corporate level management (Corporate Chief Engineer).

Nondestructive testing (NDT) personnel qualifications are to be on file for those persons employed in that capacity at the site. The QA Manual stated that the SNT level system[1/] of qualification for NDT personnel would be followed for all parts which are to meet the requirements of ASME, Section III, B&PV Code. The SNT level system is not, however, to be followed for the qualification of NDT personnel on other components. The qualifications of NDT personnel will be a subject of particular attention during subsequent CO on-site inspections.

2. Quality Control Procedures - Field Erection

The Manual contained detailed procedures relating to NDT techniques and the recording of test results. The NDT methods for which individual procedures were available included: radiography, magnetic particle, liquid penetrant and ultrasonic.

1/ Society for Nondestructive Testing, SNT-TC-1A, "Recommended Practice for Nondestructive Testing Personnel Qualification and Certification".

Typical of the several procedures was that relating to radiography. This procedure, which was six pages in length, contained the requirements and/or provided guidance in the following areas.

a. Equipment

This section covered the use of X-ray machines and radioactive isotopes (cobalt and iridium). The applicable thickness range and source intensity or voltage range was given for each type of equipment as well as the source to film distance.

b. Materials

The following film types were specified. Kodak AA or M, Dupont 506, or Ansco Superay A.

The use of lead intensifying screens and back scatter radiation control was specified.

c. Penetrameters

The type, location and identification of penetrameters, and shims as required, was specified. It was stated that one penetrameter would be used for films ten inches or less in length and two penetrameters for films over ten inches in length. An exception to the above is the case where a complete circumferential joint is radiographed in a single exposure. In this case, four penetrameters, equally spaced, are to be used.

d. Acceptance Standards

The definitions of unacceptable weld defects were observed to be consistent with those contained in ASME, Sections III and VIII, B and PV Code.

e. Records and Reports

Radiographic interpretations are to be recorded. The PDM form (No. 17955) specified for this purpose provides for the entry of information relating to: type of equipment used, penetrameter and shims used, type of film, welding process, location and description (including sketch) of defects revealed, and disposition (reject, accept or repair).

The form also provides space for the signatures of the radiographer, QA supervisor, code inspector (if applicable) and the customer's representative.

3. Non-Conforming or Variance Control

The Atkinson QA Manual contained a procedure relating to the control and disposition of non-conforming materials or workmanship. This procedure discussed in considerable detail the documentation of such deficiencies. The procedure specified the use of a form entitled "Deficiency or Variation Report" (DVR). The DVR is to contain a description of the component or part, as well as a description of the deviation. For each such deviation, provision is made on the form for indicating (yes or no) its detrimental affect on: performance, life, safety, maintainability and/or reliability.

Final disposition approval for "use-as-is" deviations, according to the procedures, is to be made by PG&E. This was a subject of particular discussion between the inspector and Messrs. Bain, Lindblad and Carr. The discussion centered on the inspector's question - "With which individual or individuals within PG&E does such approval authority rest?" The discussion revealed that such authority is not currently well defined. Mr. Carr stated that a procedure or instruction is to be prepared for the purpose of clarifying this area of authority within the PG&E project organization.

4. Miscellaneous Procedures - Not Reviewed in Depth

The Atkinson QA Manual was observed to contain procedures relating to the following subjects, which were not reviewed in depth at the time of the current inspection.

a. Drawing Distribution and Control.

b. Construction Plans and Procedures.

c. Material Identification and Storage.

d. Erection, Fitup and Welding Control

e. Weld Electrode Control.

f. Welding Procedure and Welder Qualification Records.

g. Calibration of Measurement and Testing Equipment.

h. Acceptance and Performance Tests.

i. As-built Records and Final Documentation.

These procedures will be reviewed in greater depth during future CO on-site inspections.