

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

Report of Inspection

CO Report No. 50-275/69-6

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

Date of Inspection: June 26 and 27, 1969

Date of Previous Inspection: May 6 and 7, 1969

Inspected by:

A. D. Johnson
Reactor Inspector

Reviewed by:

G. S. Spencer
Senior Reactor Inspector

Proprietary Information: None

SCOPE

Power Level:

3100 kW

Location:

Diable Canyon, San Luis Obispo
County, California

Type of Inspection:

Routine - Announced

Accompanying Personnel:

J. L. Crews, Reactor Inspector, CO:V

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SUMMARY

Safety Items - None.

Nonconformance Items - None.

Status of Previously Reported Problems - Not applicable.

Other Significant Items - For detail, refer to the section of the report shown in parentheses.

1. Guy F. Atkinson Company has been awarded the contract for the construction of the major civil structures of the facility. The Pittsburgh Des Moines Steel Company was the successful bidder for installation of the containment liner. Atkinson planned to commence construction activities at the site on July 7, 1969. (C.)
2. The excavation work necessary for the containment, auxiliary, and turbine buildings has been completed. (B.)
3. Neither PG&E's nor Atkinson's detailed quality control procedures concerning the concrete work was available for review at the time of the inspection. PG&E restated their previous position that the appropriate procedures will be approved and implemented prior to commencing actual work on Class I structures. (E.8.)
4. The contract specifications concerning the concrete manufacture, placement and testing were found to be consistent with the guidelines prescribed in PI 4600, with the exception of the deviations from the provisions of the PSAR noted in CO Report No. 50-275/69-4. (E.)
5. For economic reasons, PG&E plans to install a breakwater seaward of the intake structure for the secondary coolant. Also the plans call for the intake structures to be located further from the shore than previously indicated in the PSAR. (I.)
6. The environmental monitoring stations were observed to be maintained in an appropriate fashion. (II.)
7. PG&E's quality assurance program has been formulated and submitted to DCL (7/11/69) for review in connection with the Company's application to construct the second nuclear power plant at the Diablo Canyon site. Key individuals have been assigned to on-site quality assurance positions. Prospective quality control inspectors have received training in methods of proper manufacture, placement, curing and testing of concrete. (F.)

Management Interview - The inspectors met briefly with Messrs. Farley, Lindblad, Bettinger and Brady to discuss the findings of the inspection. Once again, the inspectors stressed the import being placed on the need for appropriate quality control procedures being in effect during the various phases of plant construction. Lindblad again reaffirmed PC&E's position that work would not commence on any given work unless such procedures were approved and implemented.

DETAILS

A. Persons Contacted

W. J. Lindblad - Design Engineer
R. V. Bettinger - Civil Engineer
F. W. Brady - Civil Engineer
R. V. Farley - Resident Engineer
H. Peterson - Field Engineer

B. Status of Construction

At the time of the visit, the inspectors observed that the excavation for the reactor, the auxiliary and the turbine generator buildings had been completed. The bedrock was observed to be covered with a thin layer of sand-dirt, etc. Mr. Farley stated that the loose dirt will be removed and the surface of the bedrock will be cleaned prior to installation of concrete. The foundations of the Class I structures are to be bonded to the bedrock as described in the preliminary safety analysis report (PSAR).

C. Major Contract Awards

Mr. Lindblad stated that PC&E has awarded the contract for the construction of the major civil structures for the facility to the Guy F. Atkinson Company. The successful bidder for the work involving installation of the containment liner was the Pittsburgh DesMoines Steel Company.

D. Construction Schedule

According to Lindblad, the Atkinson Company will begin to move men and equipment onto the site on July 7, 1969. Lindblad, stated that the placement of reinforcing steel was scheduled to commence during the latter part of July 1969, with the placement of concrete beginning in August 1969. Pittsburgh DesMoines Steel Company is scheduled to begin installation of the containment liner about November 1969.

E. Contract Specifications

The inspectors discussed the contract specifications (Contract 0031) relating to concrete with Messrs. Farley, Lindblad, Bettinger and Brady. The specifications were observed to define the responsibilities and duties of the constructor (PC&E) and the contractor.

The specifications contain detailed requirements concerning (1) concrete forms, (2) manufacture, placement, curing and testing of concrete and (3) reinforcing steel.

From a review of the provisions prescribed in the contract specifications, it was found that the inspection requirements contained in PI-4600, concerning materials and test provisions were satisfied as follows:

1. Material Specifications

- a. The specifications provide that the fine and coarse aggregate and sand are to conform and be tested in accordance with appropriate ASTM standards. However, no specific requirement was included concerning reactivity. Lindblad stated the reason for the absence of such a requirement would be reviewed to preclude an oversight of a possible needed requirement. He stated that PG&E has evaluated potential sources of aggregate materials and, as a result of this evaluation, specified limited sources of supply for these materials. He said that he was confident that the evaluation of material sources included an evaluation of potential reactivity of aggregate materials.
- b. The contract provides that the water will be clean and free from deleterious amounts of silt, oil, acids, alkali, salts, organic substances and shall contain no chlorides calculated as Cl in excess of 1,000 ppm or no sulfates calculated as SO₄ in excess of 1,000 ppm.
- c. The cement is required to conform to the specifications of ASTM C 150.
- d. Admixtures including water reducing agents, air entraining agents, Pozzolan, and retarders are to be used in accordance with the applicable ASTM procedures and standards. Use of accelerators is prohibited by the contract specifications.
- e. The specifications for admixtures, curing materials were reported in CR report no. 50-273/59-4, Section 3.

2. Concrete Design Mix

According to Lindblad, the design mixes for concrete have not as yet been established. They are to be prepared and submitted by the contractor and approved by PG&E in accordance with the following requirements.

a. Compressive Strength

<u>Class</u>	<u>Strength</u>	<u>Maximum Size of Aggregate (in.)</u>
A	5,000 psi at 60 days	1- $\frac{1}{2}$ and 3/4
B	3,000 psi at 28 days	1- $\frac{1}{2}$ and 3/4

b. Slump

<u>Description or Location</u>	<u>Maximum Slump (in.)</u>
Wall and slabs 11 inches thick or less	4
All other work	3

- c. The percentage of fine aggregate is determined by the amount passing through a number 4 sieve (35 < 50%).

The procedures, tests and methods used in determining compliance with the specifications will be based on ACI-301, Section 303 and ASTM C 192 Standard Method of Making and Curing Concrete Test Specimens in the Laboratory.

3. Rebar Splices

The specification was observed to contain requirements for fabricating and testing rebar splices. These requirements cover both welded and Cadweld splices, and they include procedures and operator qualifications. The procedure to be used for installation of Cadweld splices was specified.

Test and inspection requirements of rebar splices are delineated in the contract. Visual inspection is required for every Cadweld splice. The test schedule for Cadweld splices consists

of the following: one out of first 10 splices in No. 10, Grade 60 rebar. (This includes all tension load carrying rebar in Class I structures, according to Mr. Lindblad.) The testing schedule for each crew, position and grade of bar is to be as follows:

- one out of first 10 splices
- three out of next 50 splices
- two out of second and subsequent 100 splices
- inspector reject splices

At least 25 percent of the total number of test splices shall be made by cutting out splices from job bar. The remaining test splices may be made by having test bars tie-wired alongside the job bar and spliced in sequence with those bars (sister splices). The minimum length of splice bars have been prescribed to be three feet.

The contract specifications show that butt welded splices are to be performed in accordance with ACI 318 and American Welding Society Recommended Practice D12.1 using double-bevel or double-vee groove welds with the "short-arc" process or low hydrogen stick electrodes by shielded arc process. Both processes are to have minimum pre-heat and interpass temperatures of 400°F. Completed welds are to be wrapped with a protective blanket of insulating material to avoid rapid cooling.

Both Tensile and Nick Break-Tests for butt welds are to be performed on welded splices. The frequency of testing is to be twice that outlined above for Castweld splices.

The inspectors' review of the contract specifications failed to reveal specific requirements for the care and control of low hydrogen weld electrodes. Mr. Lindblad stated that particular attention would be given to the contractor's quality control program in this regard.

4. Batch Plant

The inspector observed that a new automatic concrete batch plant was being erected at the site. The plant was manufactured by the Erie Strayer Company, a member of the Concrete Plant Manufacturers Bureau and affiliated with the National Ready Mix Concrete Association. The plant has a rated capacity of 150 cubic yards per hour and is to be tested to assure conformance to the standards of the Concrete Manufacturers Bureau, Third Revision - effective March 1, 1967. The inspector observed that the plant had not been tested by an authorized agency. The inspector stated that all weighing and measuring equipment would be tested, sealed and certified by the local authorities having jurisdiction (County of San Luis Obispo and/or State of California).

5. Manufacture and Transportation

Concerning storing and handling, the contract required that the contractor take adequate precaution, satisfactory to PG&E, to prevent (1) segregation of aggregates, (2) intermixing of

the separate sizes of aggregate prior to batching, (3) contamination of material by dirt or other foreign substances, (4) damage to cement by dampness or weather, (5) retention of free surface water in aggregates and, (6) excessive chipping and breaking of coarse aggregate which might produce undersize accumulations. At the time of batching, all aggregates shall be dried or drained to obtain a stable moisture content that is not less than saturated surface dry nor shall the moisture content of the fine aggregate exceed saturated surface dry condition by more than eight percent. Ground storage of concrete aggregate will not be allowed. Lindblad stated that contract requirements prohibiting ground storage of aggregate materials may be waived if an absolute need is required.

Temperature for classes of concrete at the time of placement was prescribed in the specifications as follows.

- a. Shall not exceed 55°F for class A and 70°F for class B.
- b. Shall not be less than 40°F when ambient temperature is above 32°F.
- c. Shall not be below 50°F when ambient temperature is 32°F or below.
- d. Raising or lowering temperature of concrete by means of chemicals is prohibited.

Concerning placement of concrete, the specifications provide that the concrete must be placed within 45 minutes after introduction of water to the mix. Concrete showing evidence of initial set prior to placement must be discarded. Concrete is to be deposited as nearly as possible in its final position without segregation and in horizontal layers of thickness that can be satisfactorily consolidated, but not to exceed 12 inches unless otherwise directed by PG&E. The concrete is to be placed at such a rate that the concrete will be deposited on plastic concrete forms as they are prepared. If placing operations involve dropping concrete five feet or more, the concrete is to be deposited through pipes, chutes, or elephant trunk unless otherwise directed by PG&E.

The specifications do not stipulate the frequency of tests for strength, slump and air entrainment. Lindblad stated these tests were to be done by PG&E and that the quality control program will require such tests to be performed at least once for every 100 cubic yards of mix. Specified limits concerning strength and slump are given in item 2 above. Air entrainment tests are to be conducted in accordance with ASTM Test Method C231 or C173. The applicable limits were specified as follows.

<u>Coarse Aggregate, Maximum Size</u>	<u>Total Air, Percent by Volume of Concrete</u>
3/4 inch	6 ± 1
1-1/2 inches	5 ± 1

6. Curing

The contract provides that the curing of concrete may be accomplished by maintaining the concrete moist for a minimum period of seven days or by use of an approved impervious curing compound complying with the specifications of ASTM Designation C309, Type 1, 2 or 3. Uncured concrete is required to be protected against injury due to adverse weather conditions as follows.

- a. Exposed finished surfaces are to be protected from direct rays of the sun during hot weather for at least three days after placing.
- b. In cold weather, the temperature of concrete is not to be allowed to drop below 50°F for a period of at least 72 hours after placement, or until the concrete has thoroughly hardened. Where artificial heat is used, special care is to be taken to prevent drying of concrete.
- c. All concrete is to be protected from freezing for at least the specified moist curing period.
- d. Fresh concrete is to be protected from damage by rain.

7. Special Concrete

Use of grout, both dry pack (nonshrink) and pour types, is provided for in the specifications. The general requirements of procedure, manufacture, placement, temperature control and strength are provided in the specifications.

8. Records and Reports

Mr. Lindblad explained that the contractor's quality control program required by the contract had not as yet been formulated and approved by PG&E as provided in the contract (see CO Report No. 50-275/69-4, section B.). Upon approval of Atkinson's plans, PG&E, through the General Construction Department, will implement their quality control procedures as applicable to assure that the products conform to the requirements prescribed in the contract specifications. Lindblad re-affirmed PG&E's previous statements that work would not commence until the quality control program for a given job are approved and ready to implement to assure proper control of quality and appropriate documentation to reflect the quality of the work and resulting products.

F. Quality Assurance

1. Program

PG&E's quality assurance program has been formulated and submitted to DRL in connection with the company's application to construct the second plant on the site (Docket No. 50-223). That plan is currently being implemented for the construction of the Diablo Canyon No. 1 facility, according to Lindblad.

2. Personnel

Mr. Lindblad informed the inspectors of the following personnel assignments relative to the quality assurance activities.

- a. Professor C. D. Carr has accepted the position of Quality Assurance Engineer - General Construction Department. His duties will encompass providing the required technical direction of the Department's quality assurance activities at the site. Professor Carr will be directly responsible to the construction superintendent in PG&E's home office in San Francisco.

According to Lindblad, Professor Carr comes to PG&E from California State Polytechnic College located at San Luis Obispo, California where he was a member of the Mechanical Engineering faculty. Prior to joining the faculty of Cal Poly, Professor Carr was Manager, Engineering, Edwards Valve Company, Chicago, Illinois. Lindblad added that recently Professor Carr completed a visit of 13 nuclear power plants under construction to acquaint himself with problems that were being encountered by other constructors.

- b. Mr. Frank W. Brady, Civil Engineer, plans to move to the site during August. Mr. Brady has been assigned as the on-site quality assurance representative for the Engineering Department. He will monitor and direct construction quality assurance programs as they are implemented and followed. Mr. Brady stated that he holds a Masters of Science Degree in Civil Engineering with an option in structures from Stanford University. He is a Registered Professional Engineer in the State of California. Brady said that he had been employed with PG&E for about the last two years and was intimately involved with the design of the containment building. Brady reports to the Chief Civil Engineer in the Company's home offices in San Francisco, California.

3. Training

In response to the inspectors' questions concerning qualifications of PG&E quality control inspectors, Mr. Lindblad stated that 12 employees to be assigned responsibility for concrete inspection have recently completed a one week training course. The course included a review of the various tests and procedures involved in the manufacture and placement of concrete. Lindblad explained that the Engineering Department sponsored the training and had the benefit of having various manufacturers of Portland cement present to explain the importance of the various procedures and tests that must be followed.

Concerning nondestructive testing of materials, Lindblad stated that arrangements have been made with the General Dynamics Corporation in San Diego to conduct a two-week training course for approximately 24 materials inspectors. The subject matter of the course will include nondestructive testing of materials by radiographic, ultrasonic, dye penetrant, and magnetic particle methods. Lindblad said the course was scheduled for the first two weeks of August. He also explained that 8 or 9 of the attendees of the course will be assigned vendor inspection responsibilities.

G. Site Evaluation

In response to the inspectors' question concerning the "as found" geological conditions of the site bedrock, Lindblad said the Richard H. Johns, Geologist Consultant, has examined the entire area. According to Lindblad, Johns satisfied himself that the bedrock conditions were as anticipated and, therefore, confirmed the conclusions reached in the PSAR as to the suitability of the site for the intended use.

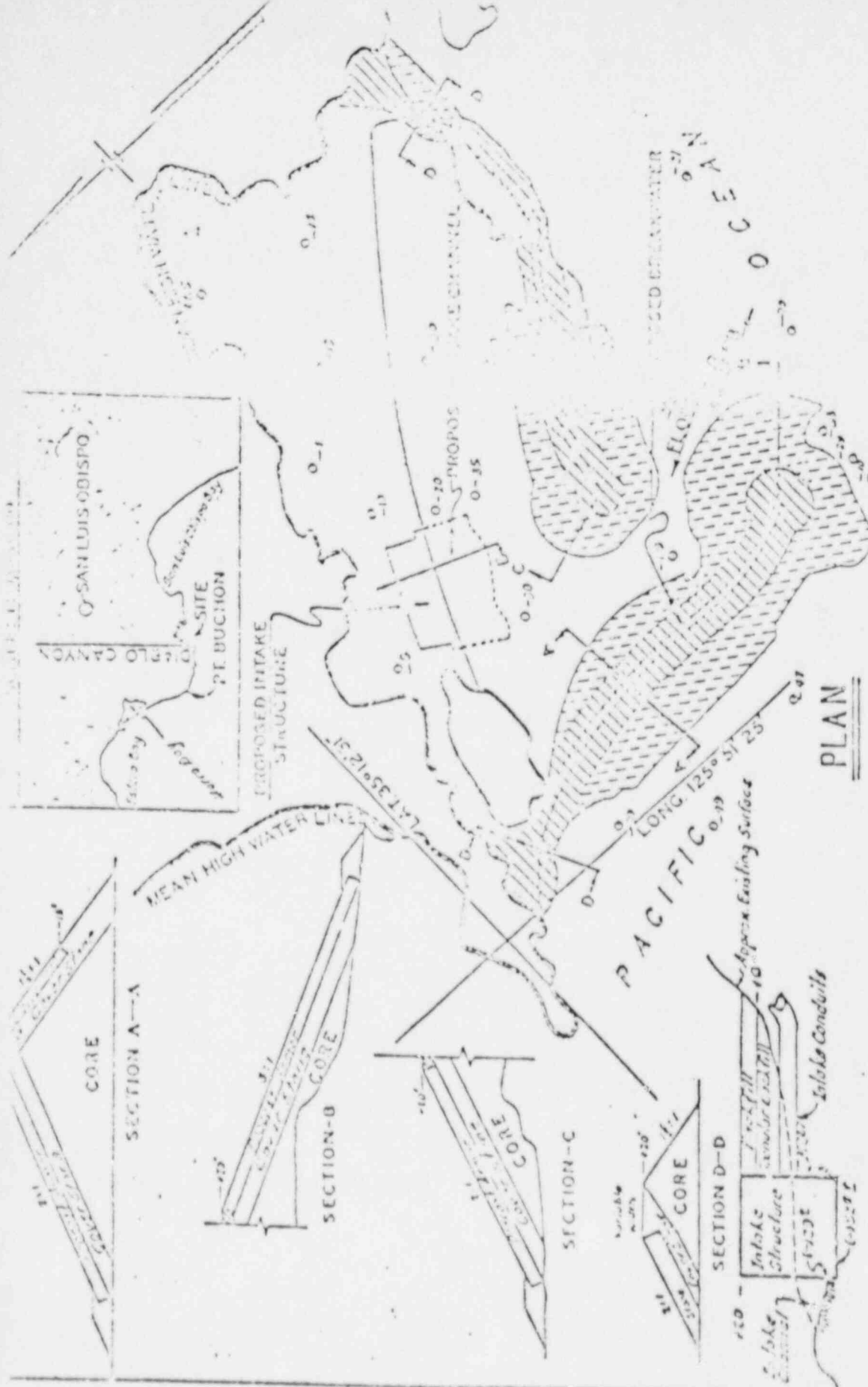
H. Meteorological Data Collecting Stations

In view of the recent information concerning deficiencies observed in meteorological data collecting stations at sites to be used for location of five of the proposed units, Lindblad stated that the stations are checked on a daily basis (5 days/week) to assure continued operation of the data collecting equipment.

During the tour of the stations, the inspectors observed that no extraneous material was in the vicinity of any of the stations and that all recording equipment was functioning. Peterson indicated that the equipment seemed to be reliable. However, he said that occasionally he would find problems, especially with the recorder pens.

I. Breakwater

Annex A attached shows PG&E's plan for installing a breakwater to protect the cove where the inlet for the secondary coolant system will be located. Mr. Bettinger stated that the breakwater is being installed for economic reasons and that failure to install it would result in a high risk of coffer dam failure during installation of the intake structure. He stated that their evaluation of the installation of the designed breakwater showed that it was neither beneficial nor detrimental to the safety aspect of the nuclear facility. He also pointed out that the intake structure will be located a couple hundred feet further into the water than was originally proposed. Installation of the breakwater is scheduled to commence during the summer of 1970, according to Bettinger.



PROPOSED BREAKWATERS, INTAKE STRUCTURE AND INTAKE CHANNEL AT ISLAND CANYON SITE

APPLICATION BY
PACIFIC GAS AND ELECTRIC CO.

SCALE: 1" = 200'
0 100 200 300 400

PLAN

- DATUM IS MEAN LOWER LOW WATER
- 0 = IS ELEVATION OF BOTTOM AT RANDOM POINTS
- [] = FILLED AREAS FOR CONSTRUCTION AND ACCESS TO INTAKE STRUCTURE AND BREAKWATERS
 - [/] = BREAKWATERS ABOVE MEAN HIGH WATER
 - [\] = BREAKWATERS BELOW MEAN HIGH WATER

SECTION A-A

