TO: Region V, Nuclear Regulatory Commission

FROM: J. B. Hoch, Diablo Canyon Project Manager

DATE: January 12, 1984

SUB: SSER 21

Enclosed are drafts of material responding to SSER 21 allegations. This information is being transmitted to you on an informal basis. Although we believe the enclosed information to be accurate, the review process required by the Diablo Canyon Project for submittals to the NRC has not been completed. We expect this information to be formally submitted to the NRC as soon as this process is complete.

J. B. Hoch

JBH/gk

Enclosures

METHOD OF THE DESIGN CONTROL PROCESS

Pacific Gas and Electric Company initially issued its design control quality assurance procedures in June 1970, in the Quality Assurance Manual (commonly referred to as the "Red Book"). The controlling procedures are identified as PRE2 and PRE3. During the initial design and construction phase of the Diablo Canyon Power Plant (DCPP) final, approved drawings (either original issue or revisions), were released by Engineering and issued to the Construction Department. Thus, as soon as the design was complete, approved drawings were released for construction.

As design changes occurred, they were documented by a description of the change in the revision block on the design drawing. Each design change was also identified by ballooning (i.e., drawing clouded circles) around the change on the drawing. The Construction Department was then responsible for issuing the drawings to the responsible contractor to accomplish the work and for assuring that the work was completed by the contractor. During this time period Engineering had adopted a practice of using a one or two letter code to identify the reason for initiating the change. For example, "(E)", in the change block indicated that the change had been initiated by the responsible engineer and "(X)" indicated that the change was required by a vendor.

Until the issuance of the fuel load license in 1981, there was no formal feedback from Construction to Engineering on the status or completion of construction activities, although Construction kept Engineering informed of status and completion via telecons and memorandums and also through the issuance of a monthly status report.

In November 1973, the Mechanical and Nuclear Engineering Department recognized the need to adhere tighter control of the design/design change process and issued a procedure called "Engineering Change Order" (ECO). The Electrical Engineering Department adopted the procedure in June, 1974. This procedure was used by Engineering to instruct the Design Drafting Department to revise a design for Engineering approval. The ECO required the following documentation:

1. Description of the change
2. Purpose of the change
3. Drawings affected by the change
4. Approval of the change prior to issuing the design.

These ECOs identified the discipline involved and were sequentially numbered, logged and tracked by the Project Engineer's office. The ECO also served the purpose of advising Construction of any pending change and could be used to transmit approved design change sketches to Construction so they could continue work while a drawing was being revised.

The ECO was replaced by the Design Change Notice (DCN) when the Engineering Manual was issued in June 1978. The DCN process, defined in Engineering Manual Procedure 3.6, "Design Change," is essentially a refinement of the ECO process. The DCN improves upon the ECO by:

1. Requiring more extensive review, coordination, and approval prior to the design being issued

2. Improving design documentation by stating the reason for the change

3. Providing for delegation to Construction to initiate and approve design changes, followed by Engineering concurrence.

Like the ECOs, the DCNs are numbered, logged, and tracked by the Project Engineer's office and are used primarily as the means by which Engineering instructs Design Drafting about drawing revisions.

The DCN identifies the scope of work to be accomplished and to make the best use of construction manpower, allows construction to proceed as portions of the design are completed. This procedure recognized that the construction activities were different from design activities and met the need by allowing revisions to the DCN as design was completed.

For example, in the electrical area the conduit layout is the first construction activity and the easiest design issue after the system (schematic) design has been completed. The first DCN issued generally would be for Construction to install the conduit. Depending on the amount of work involved, several revisions may have been required for conduit and equipment layout. The next construction activity is wire placement, which may require yet another revision. The final revision(s) would be for electrical schematics and wire terminations. Construction may initiate some revisions to help resolve construction interferences. A concept is designed by Engineering, built and understood by Construction since they are responsible for construction and start-up testing.

In April 1980, PGandE created the Nuclear Power Generation Department to consolidate the management and operation of its nuclear power plants under one organization. This department became the interface between engineering and construction activities at DCPP. All designs were issued by Engineering to

the Nuclear Projects (NP) organization of the Nuclear Power Generation Department. Nuclear Projects then issued the design to Construction.

In recognizing the requirements for design change control for an operating plant, PGandE in early 1981 formed a task force to research and develop a system that would incorporate these requirements into PGandE procedures. The task force comprised individuals from all impacted organizations including Engineering, Construction, Nuclear Projects and Plant Operations. These requirements basically were developed from TMI requirements, PGandE committments and in recognizing the problems of other plants in controlling the as-built condition of the plant for safe and reliable operation. As an initial step in developing the system, the task force solicitated other utilities to find out how they were meeting these requirements. After reviewing the responses, the task force modeled its procedures after those developed by Duke Power Company since they felt the Duke Power's procedures most adequately met the requirements.

The procedures developed by the task force established a method for assuring that all construction and other activities were complete prior to design drawings being finalized and issued. To accomplish this, a configuration control system would have to be implemented to assure that no design drawings used in the operation of the plant would be issued unless

1. All safety questions in the design were resolved
2. Construction was completed
3. Construction was accepted by the operating department
4. As-built conditions were maintained, controlled, and assembled until the design drawings were issued.

To achieve this, all designs would have to be issued as complete discipline design packages (instead of design drawings), Construction would have to work only to the design package, and any revision would have to completely supercede all previous revisions. The task force recognized that this would be a major shift from the existing design/design change process and, therefore, made the conscious decision to allow DCNs that had been issued prior to receipt of the operating license to be revised without superceding all previous revisions. However, they decided all other requirements would have to be met.

The fuel load license for Unit 1 was issued in September 1981, prior to issuance of the procedures that describe the above process. This did not change the goal of the new process because 1) the design and construction of Unit 1 was essentially complete, 2) virtually no new designs were being issued, and 3) all involved organizations understood the required process and

they agreed to follow it. The license was suspended in November 1981 after PGandE discovered and reported what has become known as the "mirror image error." Subsequently, the design verification program was established and virtually no designs were issued until after all the new design control procedures were established. The initial procedure identifying the requirements and responsibilities, Nuclear Power Generation Procedure N606, "Plant Modification Follower," was issued in May 1982. The Engineering procedure EMP 3.6DN, "Design Changes for Operating Nuclear Power Plants" was issued in July 1982.

To implement configuration control, construction activities are only conducted using the self-contained DCN design package. Construction was no longer performed in accordance with the approved issued drawings as when the plant did not have an operating license. Engineering issued only approved sketches uniquely identified with the DCN and also identifying the drawing on which the design would be incorporated. The design control of the DCN is Engineering's responsibility. Although it is the individual engineer's responsibility to know the design he issues, it is generally controlled by the creation of a "master" from the original drawing. All DCN changes are made on the master, and the specific DCN change is converted to a sketch using an alpha-numeric revision for issuing with the DCN. This master allows

engineering to maintain a composite of all changes affecting a drawing. Some engineering disciplines have also developed logs, composite cross-reference drawings, cross-reference indexes and use both Records Management System (RMS) and DCN tracking logs sorted by drawing number to assist in controlling design change.

The RMS is a computer-based document storage and retrieval system used at DCPP that contains a list of all drawings issued. When a DCN is issued for construction, the drawing to be revised is flagged in the RMS to show that a DCN is still outstanding against it. The DCN tracking system (System 38) is a computer-based system used for tracking all DCN's through all responsible organizations from inception through final closeout.

The manual drawing log was converted in May 1982 to the computer-based, real time DCN tracking system for a greatly expanded tracking process. The system has been expanded over time to include information from Engineering and other departments such as drawings affected, interim revision number, responsible engineer, priority schedule, expediting codes, and construction group assigned.

The flow chart attached to EMP 3.60N gives the detailed activities of the engineering process and a general overview of construction and operations activities. Construction's process is detailed in Project Instruction PI 17, "Document Control Operating Instructions." Operation's process is detailed in their Administrative Procedure, AP C-1 S1, "Onsite Review and Handling of Plant Modifications." The process is briefly as follows:

1. Engineering completes and approves complete design packages by discipline, and transmits to Nuclear Plant Operations in San Francisco (NPO-SF).

2. NPO-SF reviews the DCN, completes the written safety evaluation, and transmits to NPO at Diablo Canyon (NPO-DC).

3. NPO-DC reviews the package for operational requirements (e.g., additional training), obtains the Plant Staff Review Committee (PSRC) approval of the safety evaluation, and assigns and transmits the work to Construction.

4. Construction Document Control coordinates distribution to the responsible groups. The Construction Resident Engineer assigns the work responsibility to a contractor and to his own personnel to follow the work. After the work has been completed, Construction routes the completed package (including as-builts) to cognizant personnel. When they verify that all construction activities (including construction testing) have been completed, Construction transmits the package back to NPO-DC.

5. NPO-DC reviews the returned package for operational acceptability, distributes the design sketches to all their drawing control points, and returns the package to Engineering.

6. Engineering reviews the package (including any as-builts) for acceptability, incorporates the information into design drawings, then approves and issues the drawings.

In 1979, NPO and Engineering had jointly identified the drawings necessary to safely operate and shut down the plant as required by EMP 3.7. These are identified as Priority 1 drawings and Engineering committed to issuing these drawings within thirty days after receiving the completed design package from

NPO in accordance with EMP 3.60N. All other drawings are to be issued within ninety days. In the meantime, NPO is able to assemble the as-built condition of the plant since the information has been sent to their drawing control points and the information is available through the RMS on which DCN's affect a drawing.

As a result of the Internal Technical Program (ITP) instituted by the Diablo Canyon Project (the integrated PGandE/Bechtel project), Constructon was asked to review all DCNs issued prior to EMP 3.60N and verify that the work had been completed. These DCNs are easily identifiable since the numbering system was changed with the implementation of EMP 3.60N. Revisions to these DCNs that were allowed after EMP 3.60N are also easily identifiable since they were required to have a Plant Modification Follower (PMF) attached which documents completion of all Engineering, Construction, and Operation activities. This information is readily available on the DCN tracking system. Construction documented to Engineering that work was complete by so indicating on the DCN tracking system. This activity was formalized by issuing DCP Project Procedure 111-10 on November 2, 1983. This procedure requires that all of the old DCNs that Construction had not verified as completed be returned and documented under the requirements of EMP 3.60N from the time of construction through operations and engineering..

METHOD FOR INSURING CLOSURE OF COMPLETION OF WORK

AND

CONTRACTOR REPORTING OF WORK COMPLETION

During the initial design and construction phase of the Diablo Canyon Power Plant (DCPP) final, approved drawings (either original issue or revisions), were released by Engineering and issued to the General Construction (G.C.) Department. This as soon as the design was complete, approved drawings were released for construction. Construction was considered complete when the contractor submitted documentation that indicated satisfactory verification of installation, e.g., completion of loop tests and dry run tests for electrical circuits.

Throughout the construction phase the methods for initiating and identifying completion of construction have been modified. PGandE/PTGC personnel have always been assigned to follow the progress of the work throughout the various methods of design change.

Where required by the contracts, a new issued design was assigned to the contractor via Work Request, Field Change Orders, etc. These documents were assigned sequential numbers for identification tracking and accounting purposes.

To ensure the as-built information was incorporated onto the appropriate design drawing, a sketch number was assigned when the as-built drawing was submitted to Drawing Control. The sketch was logged against the affected drawing, copies transmitted to San Francisco via transmittal Form #77-G-4, and distribution made, including to the contractor. Upon contractor receipt of the as-built drawing, the construction resumed to its completion. Whereupon the contractor notified PGandE/PTGC that the work was complete via Construction Completion Notices. (i.e., Completed Work Requests, Circuit Completion Lists for Specific DRT, Loop Tests, Hydro Tests, etc.) In all cases the final acceptance was based on documentation that the Contractor was required to provide with the various work packages, which included Q.C. sign-off by the Contractor. Receipt of this notification allowed the disciplines to perform the appropriate tests and ultimately release the system to startup for preoperational testing.

Simultaneous with construction the as-built information was incorporated on the applicable drawing by Project Engineering (P.E.). Upon G.C. receipt of the as-built incorporated design documents, the responsible onsite inspector would go to Drawing Control, get the applicable sketch, verify that the sketch information had been incorporated on the applicable drawing, place "incorporated" stamp on the sketch, then sign and date the sketch. Drawing Control would then transfer the sketch to the closed file.

In November, 1973, the Mechanical discipline started the use of Mechanical Engineering Change Orders (ECOs) and the Electrical discipline commenced a similiar program in March 1974.

The ECO required the following information:

- a description of the change,
- the purpose of the change,
- the drawings affected by the change,
- approval of the change prior to issuing the design.

The ECO process only allowed the work to proceed on the basis of the approved design. ECO's were considered completed upon incorporation on applicable design drawings. And the completion of the work associated with an ECO was tracked and completed in the same manner as a new design.

During a brief period between the ECO program and the Design Change Notice (DCN) program, the as-built Minor Variation Report (MVP) was used by the Electrical group for expediting completion of construction work. This involved Q.C. documentation and tracking for closure.

In January 1978, the method of transmitting field changes was modified. Transmittal form #77-C-4 was replaced with Field Change Transmittal (F.C.T.) form #62-5537.

The ECO process was in effect until the Engineering Manual was issued in June 1978, and Engineering Manual Procedures 3.6, "Design Change", and 3.7, "As-Built Documents" became the controlling engineering documents for design issues and incorporation. Design Change Notices (DCNs) require review, coordination, and approvals prior to initial issue of design, and allowed, by specific delegation to the Resident Engineer, thereby allowing field approval of certain design changes with Project Engineering concurrence taking place simultaneously with the continuing construction, but prior to incorporation into the design documents. DCN's were numbered, logged and tracked by the Project Engineer's office. The DCN also was used by Engineering to instruct Design Drafting to revise drawings.

The DCN identified a specific scope of work to be accomplished and allowed construction to proceed as portions of the design were completed, to facilitate the optimal use of construction manpower. This procedure recognized there was a need for General Construction to proceed with construction prior to full completion of all design activities, as long as the approved design was included.

For example, in the electrical area the conduit layout is the first construction activity and the easiest design issue after the system (schematic) design has been completed. The first DCN issued generally would be for Construction to install the conduit. Depending on the amount of work involved, several revisions may be required for conduit

and equipment layout. The next construction activity is wire placement, which may require yet another revision. The final revision(s) would be for electrical schematics and wire terminations. Under their delegation, Construction may initiate some revisions to facilitate resolution of construction interferences.

In September, 1981, the G.C. DCN closure process was formalized, and the form used was the fore-runner of the present DCN Completion Notice Form (OE-86). The system of contractor notification of construction completion was not substantially changed as a result of the initiation of the DCN process.

In October, 1982, G.C. started a review process of all DCN's that work had been initiated prior to September of 1981 to determine the current construction status.

The status of the various DCN's since the beginning of the DCN program was obtained from the Drawing Control logs of all DCNs and revisions received or generated at the site. Status tables based on the logs were distributed to the onsite disciplines. The various disciplines checked early records and work to confirm the construction status of these DCN's. The information from the various disciplines was

then tabulated and forwarded to San Francisco Project Engineering for their use. A copy of the information forwarded to Project Engineering was maintained by G.C. All DCNs not shown as closed status were then later addressed by the responsible discipline. The first updates were transmitted to engineering for insertion to Records 80 on a hard copy basis until the System 38 program was implemented.

After the System 38 program was initially updated and implemented, the construction status information was provided to the data base directly by inputing through onsite terminals tied to the master data base in the Home Office. The maintenance of construction status of all DCN's is ongoing.

Periodic audits by G.C. Document Control personnel have been performed on Contractor's work documents to insure that they were working to the latest design changes. The Contractor is required to submit to PGandE/PTGC documentation identifying work completed as well as in process inspections and final inspections.