

BECHTEL CORPORATION  
POWER AND INDUSTRIAL DIVISION  
QUALITY ASSURANCE PLAN  
FOR  
MIDLAND PLANT - UNITS 1 & 2

INTRODUCTION

Consumers Power Company has assigned the responsibility for the design, procurement of equipment (other than the NSS), and construction of the plant to Bechtel. Bechtel will perform the quality assurance effort for all phases of plant engineering, shop fabrication (including the NSS), field fabrication, and construction. This effort will be applied to all critical items and systems so designated on the "Q-List."

The Bechtel Nuclear Quality Assurance Manual, Revision 4 (hereafter referred to as NQAM), is the basis for the quality assurance programs on Bechtel Power and Industrial Division nuclear projects. The guidelines for implementing and maintaining the Bechtel Quality Assurance program for the Midland Plant will be contained in this document, referred to herein as the Quality Assurance Plan.

PURPOSE

The general purpose of this quality assurance plan is to assure that materials, equipment, and workmanship employed in the construction of the Midland Plant conform to high standards of quality consistent with public safety and plant reliability. Documentation will be provided by the quality assurance program to demonstrate that the requirements are met.

SCOPE

This plan will describe the policies, practices, and procedures to be followed in implementing and maintaining an effective, documented quality assurance program during the design, procurement, and construction stages of the Midland Plant.

Responsibilities and authorities of the organizations and individuals involved in the Bechtel quality assurance program will be defined and the major structures, systems, and components covered by this program will be identified.

QUALITY ASSURANCE PLAN

ORGANIZATION

The organization employed for implementation of the Bechtel Quality Assurance Program on the Midland project is shown in Figure 1. The program covers three main phases of the project, namely: Design, Procurement, and Construction. The personnel having quality assurance related functions are listed for each phase.

A. Design Phase

Project Engineering Team  
Quality Assurance Engineer  
Chief Engineers and their Technical Staffs  
Engineering Manager  
Manager - Quality Assurance  
Quality Assurance Coordinator  
Metallurgical and Quality Control

B. Procurement Phase

Project Engineering Team  
Quality Assurance Engineer  
Chief Engineers and their Technical Staffs  
Engineering Manager  
Manager - Quality Assurance  
Quality Assurance Coordinator  
Metallurgical and Quality Control  
Shop Inspectors

C. Construction Phase

Project Engineering Team  
Quality Assurance Engineer  
Chief Engineers and their Technical Staffs  
Engineering Manager  
Manager - Quality Assurance  
Quality Assurance Coordinator  
Metallurgical and Quality Control  
Project Field Engineer  
Quality Control Engineer  
Field Engineers

The authority and duties of the personnel involved in the various phases of the quality assurance program are as follows:

A. Project Engineering Team

The project engineering team has primary responsibility for implementing the quality assurance program. They prepare drawings, specifications, purchase requisitions, and bid evaluations in accordance with the quality requirements. They also prepare and implement the Q-List and design control check list, review fabrication and inspection procedures, and shop inspection reports. Through the quality assurance engineer they provide surveillance of field engineering, quality control, and construction activities.

B. Quality Assurance Engineer

The quality assurance engineer (QAE) is the field representative of the project engineering team, and receives supervision and technical support from

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the project engineer. However, the QAE is assigned by, and administratively reports to, the manager-quality assurance. Prior to commencement of construction he is stationed in the home office to assist the project engineer and design supervisors in the implementation of the quality assurance program.

At the jobsite the QAE performs quality assurance surveillance of field activities including engineering, quality control, and construction activities. He reviews and accepts inspection reports, performs audit of the field QA/QC documentation files, and monitors the overall quality control program.

The quality assurance engineer has the authority to stop field work in the event of nonconformance with drawings, specifications, and procedures established for structures, systems, and units on the Q-List. He also serves as field contact for the applicant's quality assurance organization and others concerned with quality assurance in the field.

C. Chief Engineers

The Bechtel organization provides for a chief engineer for each discipline (eg, civil, mechanical, etc) to provide technical support and coordination of the engineering design supervisors. Since the engineering effort for the project is under the sole direction of the project engineer, the chief engineers qualify for the necessary independent review of engineering.

The chief engineers provide independent documented review for all items on the design control check lists. In so doing, they coordinate and assure necessary technical review by specialists and consultants. Chief engineers may delegate review to qualified specialists on their staffs.

D. Engineering Manager

The engineering manager provides management guidance and surveillance of the Midland Plant and other nuclear project engineering activities. His QA-related functions involve verification through project reviews that project engineering is carrying out its QA responsibilities as well as other design responsibilities.

E. Manager - Quality Assurance

The manager-quality assurance is responsible for overall direction of the quality assurance program including formulating and implementing policy, administration, and coordination of the program and administrative and technical supervision of the quality assurance engineers and coordinators. He is responsible for providing overall coordination of engineering, procurement and construction departments in quality assurance activities to effectively implement the program.

F. Quality Assurance Coordinator

The quality assurance coordinator reports to and assists the manager-quality assurance in carrying out and implementing all activities related to the quality assurance program. His responsibilities include coordinating and

assigning QAE, reviewing and evaluating project quality assurance programs, and auditing the performance of the various programs. He provides an independent channel for QAE communication to management.

G. Metallurgical Quality Control

The quality assurance aspects of metallurgy and welding activities are coordinated by metallurgy and QC services. Their function includes preparation of specifications and procedures for materials, fabrication, and nondestructive testing plus providing technical consultation and guidance for engineering, procurement, and construction. In addition, they provide welding and inspection training services at the jobsite.

H. Shop Inspectors

The shop inspectors are responsible for shop qualification inspections, in-process inspection of work in suppliers' shops, checking of documentation and final inspection and release of equipment, for shipment. Their activities are carried out in accordance with the Procurement Department Inspection Manual and as supplemented by the drawings, specifications, and additional instructions provided by engineering.

I. Project Field Engineer

The project field engineer's duties include the supervision of quality control inspection at the jobsite. In carrying out this assignment, he assigns qualified field engineers to perform quality control inspections. He supervises the preparation of inspection check lists, verifies accuracy and completeness of inspection reports, and ascertains that defects are removed and that repairs are carried out in accordance with applicable specifications, instructions, and procedures. The field quality control program is carried out in accordance with the Bechtel Nuclear Quality Assurance Manual, the Bechtel Field Inspection Manual and as supplemented by the drawings, specifications and additional instructions.

J. Quality Control Engineer

The quality control engineer reports to and assists the project field engineer in carrying out quality control inspection responsibilities. He normally is assigned responsibility for review of inspection reports, coordination, training and advising field engineers in the performance of quality control inspection assignments, coordination of testing laboratories, and overall detailed execution of field inspection and maintenance of the field QC/QA files.

K. Field Engineers/Inspectors

Field engineers/inspectors carry out the inspection assignments and are responsible for completing the appropriate inspection forms. Field engineers/inspectors function on a disciplinary basis, eg, mechanical equipment, civil/structural, electrical/power, instrumentation/control, and welding/metallurgy. The number of inspectors assigned varies depending upon the requirements of the quality control inspection workload and construction schedule. They have access to all the design drawings, applicable codes, and sampling and testing procedures pertaining to their inspection assignments.

#### L. Material Supervisor

The material supervisor is responsible for normal receiving inspection and storage of material and equipment prior to installation. He performs his duties in accordance with the NQAM, field procurement procedures, and additional instructions provided by engineering.

#### QUALITY ASSURANCE PROGRAM

The quality assurance program covers all phases of the project including engineering, procurement and construction from initial design development through acceptance by the client.

The scope of the quality assurance program is defined by the Q-List which is a list of critical items requiring quality assurance coverage. This list includes all structures, equipment, and systems associated with the reactor primary coolant boundary, engineered safeguards, emergency cooling systems, reactor containment, and containment cooling systems. Other systems may be added at the discretion of the client, nuclear steam supply system seller (for items in his scope of supply), chief engineers or the project engineer. Since the Q-List is a working document and therefore will be updated periodically to give more detail, a basic Q-List in sufficient detail to show the general scope of the Bechtel QA program for the Midland Project is included (Figure 2).

The Q-List is prepared by the project engineering team, then reviewed and approved by chief engineers. The degree of inspection and control afforded items on the Q-List is determined on a case-by-case basis by the project engineering team through consultation with the chief engineers and Bechtel's technical specialists. Factors considered in establishing the degree of control include: nature of the item, importance of the item to plant safety and reliability, previous experience with this or comparable items, capabilities of potential vendors or subcontractors, and requirements of applicable codes or standards. Where deemed necessary, Bechtel engineering documents include specific procedures or requisites for the production and quality assurance of the item or request their preparation by the organization responsible for manufacturing or erection.

The following basic principles are applied in the accomplishment of the quality assurance program:

- A. The project engineering team has primary responsibilities for quality in the design phase.
- B. Vendors and subcontractors have primary responsibilities for quality of materials, equipment, and services furnished by them.
- C. The Bechtel project field organization supervised by the project superintendent has primary responsibility for quality of construction performed directly by Bechtel.
- D. One or more levels of inspection or checks are provided as required within the organization having primary quality responsibilities.

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The quality assurance program provides for at least one level of monitoring and verification by individuals not under the direct control of the group having primary responsibility for quality (eg, the quality assurance engineer surveys construction, Bechtel shop inspectors survey vendors, etc). Beyond this, quality assurance audits of engineering and field operations are carried out under the direction of the quality assurance coordinator.

#### DESIGN CONTROL

Several levels of design review and approval are applied to significant design aspects of Bechtel work. These standard practices include:

- A. Checking and review by design and engineering level personnel within the project engineering team having technical qualifications comparable to those of the engineer or designer who originated the work.
- B. Review and approval by the originating engineer's design supervisor.
- C. Review and approval by the project engineer.
- D. Review and approval by the appropriate chief engineer of key design drawings specifications and documents such as electrical single-line drawings.

For structures, systems and components on the Q-List, additional design control measures are implemented. A Design Control Check List is prepared which identifies drawings, specifications, and other data (including the Q-List) which shall be reviewed by chief engineers or technical specialists under the chief engineer's direction. The Design Control Check List is agreed on by the project engineer and the cognizant chief engineer soon after initiation of the project. When periodic design reviews are deemed necessary, chief engineers and the project engineer agree on appropriate schedules and procedures. When an item identified in the Design Control Check List has been completed, the cognizant chief engineer will have a final review performed and execute a design control approval signifying that the necessary initial, periodic, and final review and monitoring work has been completed and the item is satisfactory from the standpoint of quality assurance requirements. Specifications, design and interface information and systems criteria developed by the nuclear steam system supplier are submitted by the supplier to Bechtel for review. Drawings, specifications, and procurement packages are also routinely submitted to the client for appropriate review.

The project engineering team employs several documents to establish design requirements for the project. These documents include or incorporate applicable AEC regulatory requirements and design bases as proposed by the license application and accepted by the AEC, basic client-furnished data defining plant requirements, basic engineering data amplifying the basic client-directed project data, NSS supplier furnished criteria and data, project criteria and Bechtel design guides, standard specifications and data sheets.

#### PROCUREMENT DOCUMENT CONTROL

Technical aspects of procurement documents are prepared by the project engineering team in accordance with the procedures described in the preceding section. Appropriate vendor quality assurance program requirements are incorporated in the

procurement documents. Provisions are made for periodic and final inspection in vendor shops as appropriate. All procurement, whether carried out by home office procurement department, or the field procurement organization, employs specifications and quality assurance requirements established by the project engineering team.

#### INSTRUCTIONS, PROCEDURES AND DRAWINGS

General procedures for carrying out engineering, procurement and construction are contained in the following manuals and documents:

- A. Project Engineer's Manual containing requirements for carrying out engineering activities.
- B. Nuclear Quality Assurance Manual defining responsibilities and outlining quality assurance activities and procedures.
- C. Field Inspection Manual describing general guidelines and procedures for field inspection.
- D. Procurement Department Inspection Manual containing shop inspection instructions, guidelines and procedures.
- E. Field Procurement Procedures specifying field purchase instructions for field purchases and material receiving inspection.
- F. Bechtel general and technical engineering standards including nuclear power station design standards which establish selective criteria, guidelines and standards for station design.

These are supplemented by specific instructions and procedures which may be prepared by engineering, obtained from vendors, or prepared by vendor, subcontractor, or Bechtel construction personnel as required. When appropriate, such instructions and procedures are reviewed and approved by the project engineering team and Bechtel specialists.

#### DOCUMENT CONTROL

The review and approval of design documents is covered in the "Design Control" section. Approved drawings and specifications are promptly issued to individual organizations and individuals performing the work and to those responsible for inspection. Changes made by the project engineering team or proposed by field engineering to approved drawings are reviewed and approved by the project engineering team in accordance with procedures for review of the initial issue. Where significant changes are involved, review by cognizant chief engineers and/or technical specialists is performed.

The project field organization is responsible for implementation of a field procedure that will control the distribution of approved drawings and assure that obsolete drawings are voided or destroyed.

The quality assurance engineer will monitor field engineering activities to verify that field engineering changes are reviewed and approved by the project engineering team. He will also make spot checks to assure that a drawing control log is being maintained and that only current design documents are in use.

## CONTROL OF PURCHASED MATERIAL, EQUIPMENT AND SERVICES

The Bechtel quality assurance program includes a comprehensive system to assure that all purchased material, equipment and services conform to the procurement documents. It provides for evaluation of vendor's quality assurance program and preparation of procurement specifications incorporating quality assurance requirements. The quality assurance requirements include an appropriate vendor quality assurance program, purchaser surveillance as required, vendor preparation and maintenance of appropriate test and inspection records, certificates and other quality assurance documentation and vendor submittal of quality control records considered necessary for purchaser retention to verify quality of completed work.

Bechtel shop inspectors review and verify vendor quality assurance records and prepare reports documenting vendor data not submitted to purchaser. Where Bechtel shop inspection is performed, a final inspection of the finished item is carried out in the vendor's shop prior to release for shipment; Bechtel field procurement procedures provide for receipt inspection by the material supervisor on all materials and equipment delivered to the jobsite. For significant items or critical materials which form parts of Q-List systems, Bechtel field engineers carry out an independent receipt inspection and prepare receiving reports which supplement receiving reports required by standard field procurement procedures. Bechtel procurement procedures also provide for periodic audits of vendor quality assurance activities as appropriate.

## IDENTIFICATION AND CONTROL OF MATERIALS, PARTS AND COMPONENTS

As applies to vendors, appropriate requirements for identification and control of materials, parts and components will be established through review of the vendor's quality assurance program and procedures agreed to prior to bid award. Bechtel field procedures and practices incorporate measures for material control, including segregation of nonconforming items, and for marking and identification as required. Traceability will be accomplished where required by code, standard, or specification. In other cases, measures such as physical separation or appropriate marking procedures are used to identify and control materials or components of specific type, specification, class, etc. Positive control of nonconforming items will be maintained by suitable markings and/or segregation (see "Nonconforming Material, Parts or Components").

## CONTROL OF SPECIAL PROCESSES

Use of qualified procedures and application thereof as required by established codes and standards will be rigidly enforced on all Bechtel vendors, subcontractors and Bechtel personnel. For other special processes identified by equipment suppliers or project engineering, procedures will be prepared by equipment suppliers, project engineering, or field engineering and approved by appropriate personnel in the organization which identified the process. Personnel performing such operations will be trained and carefully supervised by personnel familiar with the specific process.

## INSPECTION

Bechtel performs periodic and final inspection of vendor work as described previously. This is normally performed by shop inspectors; however, in special



cases engineering personnel participate in such inspections. Inspection practices normally include witnessing of significant tests, as appropriate, and requirements for vendors to accept mandatory hold-points where, in the opinion of Bechtel inspectors, work should not proceed without prior examination by the Bechtel inspector.

For field operations, in-process, and final inspection of activities affecting quality are carried out by Bechtel field engineers with knowledge of the discipline involved, project requirements and the inspection process. Field inspection is carried out in accordance with guidelines and procedures contained in the Bechtel Field Inspection Manual supplemented by approved procedures for special processes and specific project requirements. Field inspection operations are supervised by the quality control engineer and monitored by the quality assurance engineer. Reports or records of inspection operations are prepared by the field engineers/inspectors, approved by the quality control engineer, accepted and distributed by the quality assurance engineer.

#### TEST CONTROL

Supplier and subcontractor test operations, including procedures as appropriate, are reviewed in accordance with procurement procedures previously described. In the field, certain test operations are carried out by the construction organization in the course of plant construction. Subsequent to completion of construction, the Bechtel startup organization may be involved in system checkout and startup operations. Construction tests are normally performed in accordance with standard construction practice or via specific test procedures as specified by the project engineering team. Results of required tests are documented.

#### CALIBRATION OF MEASUREMENT AND TEST EQUIPMENT

Vendor procedures for control of measurement and test equipment are reviewed as appropriate in evaluating the vendor quality assurance program. In the field, a standard written procedure is followed to provide control and periodic calibration of special tools, measuring and test equipment.

#### HANDLING, STORAGE, SHIPPING AND PRESERVATION

Special handling, storage, shipping and preservation requirements are identified in procurement specifications for vendor's work. In the field, materials and equipment are stored in accordance with standard procedures as well as specific requirements and any special procedures issued by the project engineering team. These are prepared by the field organization, approved by the project superintendent and reviewed by the project engineering team. When special environmental preservation is required, documentation of the conditions is provided.

#### INSPECTION, TESTS AND OPERATING STATUS

Documentation of inspections and tests is provided by inspection reports or other records. This documentation identifies the items that conform to inspection and test requirements. Nonconforming items are reported and tagged (see "Nonconforming Material, Parts or Components"). Current practices provide for the project field organization to develop specific procedures for the marking, tagging, or otherwise indicating inspection and acceptance status of items and/or systems.

## NONCONFORMING MATERIAL, PARTS OR COMPONENTS

The Bechtel Quality Assurance Program provides measures which control materials, parts or components not conforming to prescribed requirements to prevent their inadvertent use or installation. Materials are physically controlled in accordance with procedures described under "Identification and Control of Materials, Parts and Components." For nonconforming items which may be made usable through rework, repair or modification of requirements, reports are prepared and submitted to the project engineering team for appropriate guidance. Records of resolution for these cases are prepared and incorporated in quality assurance files. Where rework, repair or approval for use is not feasible, nonconforming materials are either removed from the construction site or utilized in systems or structures where their characteristics satisfy requirements for such systems.

## CORRECTIVE ACTION

The Bechtel quality assurance program incorporates procedures for identification and reporting of situations which are deemed adverse to quality through preparation of "Significant Deficiency Reports." These include reports of significant failures, malfunctions, deficiencies, deviations, defective material, etc, that cannot be resolved at the site and/or require management attention. Routine occurrences of rework generally anticipated for the activity involved are not normally included in the corrective action program. The report is initiated by the quality assurance engineer and reviewed by the project engineering team, chief engineers, and/or engineering specialists. Copies are sent to the QA coordinator and manager-quality assurance. Upon resolution of the problem the project engineer completes the "Significant Deficiency Follow-up Report" and transmits the report to the quality assurance engineer with the same distribution of copies as the initial report.

The "Significant Deficiency Follow-up Report" is classified as Bechtel confidential information and will not be incorporated in project quality assurance files. This policy is followed in order to permit free, factual reporting of all situations, some of which may involve personnel evaluations, etc. A summary of these reports will be incorporated in the project quality assurance records.

## QUALITY ASSURANCE RECORDS

Copies of all documentation pertaining to the quality assurance program, prepared by Bechtel or obtained from vendors and subcontractors, are collected in project quality assurance files. However, as noted in the preceding section, only the summary logs of "Significant Deficiency Reports" are included. These files are available for audit by management and the client during the design and construction period and are turned over to the client at the completion of the Bechtel contract. Detailed Bechtel quality assurance audit reports are not included in such files, but, summary records and conclusions will be made available.

## AUDITS

The quality assurance program includes four specific audit activities:

- A. Periodic audits of project engineering activities and records are carried out by, or under the direction of, the quality assurance coordinator.

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- B. Bechtel shop inspectors carry out periodic audits of vendor's quality assurance program and records.
- C. Quality assurance engineer carries out frequent audits of field inspection activities and reporting.
- D. Periodic audits of field quality assurance and inspection activities are carried out under the direction of the quality assurance coordinator.

All of the above are carried out, on a sampling basis, periodically during the design and construction period. At the completion of construction for systems and structures subject to the quality assurance program, a final inspection is performed on the work and associated quality assurance records to assure necessary inspections and records have been prepared and are on file. A final inspection report is prepared confirming this final examination and audit.

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