APPENDIX A

QUALITY ASSURANCE

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APPENDIX A

QUALITY ASSURANCE

A.1 QUALITY ASSURANCE PROGRAM

A.1.1 Quality Assurance Program - Overall Description

A project Quality Assurance Program is in effect for the design, procurement, fabrication, erection and testing of components and systems, operations and maintenance of the Beaver Valley Power Station Unit No. 1 (BVPS-1). Ultimate responsibility for the Quality Assurance (QA) Program rests with the licensee. The program entails quality assurance throughout all phases of this project as follows:

1. Conceptual design
2. Detailed engineering and design
3. Assembly and maintenance of quality control documentation for shop and field
4. Vendor selection
5. Surveillance of Vendor's shop inspection
6. Witnessing of key shop tests
7. Field inspection and quality control of erection
8. Equipment, installation, and testing specifications
9. Checkout of mechanical, fluid, and electrical systems
10. Startup testing
11. Periodic inservice performance tests.

The detailed working implementation of the Quality Assurance Program during the design and construction phase was delegated to Stone & Webster Engineering Corporation (S&W), as agents for Duquesne Light Company, and to Westinghouse Electric Corporation, contractor for the Nuclear Steam Supply System. The Quality Assurance Organization shown in Figure A.1-1 describes the relationships which implemented the Duquesne Light Company Quality Assurance Program during the design and construction phase of BVPS-1.

A Quality Assurance organization has been developed with responsibility for auditing the Quality Assurance Program.

Figures A.2-1 and A.2-2 show the Duquesne Light Company organization for quality assurance during the design and construction phase of BVPS-1. Figures A.3-1, A.3-2, and A.3-3 show the S&W quality assurance organization. Figures A.4-1, A.4-2, and A.4-3 depict the quality assurance organization of Westinghouse, the supplier of the Nuclear Steam Supply System. The S&W Quality Assurance Coordinator had direct contact with the Duquesne Light Company Quality Assurance Manager for quality assurance matters, as well as with the Westinghouse Project Manager during the design and construction phase.

Appendix A is organized as follows:

A.2 - Duquesne Light Company Quality Assurance Program

A.2.1 - Duquesne Light Company Design and Construction Quality Assurance Program applicable at the latest revision of the original FSAR (Amendment 18 dated November 1975), BVPS-1

A.2.2 - Operations Quality Assurance Program, BVPS-1, (Refer to FENOC Quality Assurance Program Manual)

A.3 - Stone & Webster Engineering Corporation Quality Assurance Program used during the Design and Construction Phase, BVPS-1

A.4 - Westinghouse Power Systems Division Quality Assurance Plan used during the Design and Construction Phase, BVPS-1

A.5 - Westinghouse Nuclear Fuels Division Reliability and Quality Assurance Program, BVPS-1

A.1.2 Quality Assurance Categories

Equipment and structures, whether safety related or not, are subject to engineering review, and shop and field inspection to a degree proportional to the value of the equipment and to its contribution to safety, accessibility, reliability and operability.

The three quality assurance categories defined below are not levels of quality per se, but rather denote differences in application of the Quality Assurance Program. Category I and only Category I is intended to include activities affecting structures, systems, portions of systems, and equipment to which the 10CFR50, Appendix B criteria apply, i.e., structures, systems, portions of systems, and components which are safety related. Within that category, there may be differences in the quality specified, depending upon the nature of the component and upon its contribution to public safety (e.g., the rebars in the intake structure differ in this respect from the material in the reactor vessel), but the formal Quality Assurance Program incorporating the intent of the eighteen criteria in Appendix B to 10CFR50 applies without exception to all items classified as Category I.

The equipment and structures in Categories II and III are not safety related when considered in the above context. Hence, the applicability of the Quality Assurance Program for these categories is not determined by the eighteen criteria in Appendix B to 10CFR50 but rather by the Applicant's policy and is a matter of agreement between the Applicant and his agents and suppliers. Costly and critical power generation equipment in Category II normally are specified and inspected to a degree comparable to that afforded important safety-related equipment in Category I, but procedural aspects of quality assurance may be somewhat less stringent if so agreed to by the Applicant.

The various "classes" such as "piping class", Seismic Category I, etc., should not be confused with the quality assurance categories nor considered as subdivisions of the three categories.

The three quality assurance categories are defined as follows:

1. Category I - Plant systems, or portions of systems, structures and equipment whose failure or malfunction could cause a release of radioactivity that would endanger public safety. This category also includes equipment which is vital to a safe shutdown of the plant and the removal of decay and sensible heat, or equipment which is necessary to mitigate consequences to the public of a postulated accident.

2. Category II - Plant systems, portions of systems, structures and equipment that are essential for the reliable generation of power but which are not essential for a safe shutdown. Failure of this equipment could result in loss of generation but would not endanger public safety. A QA Category II designation is also applied to those systems and components which contain radioactive materials but whose failure would not effect public safety.

3. Category III - Plant systems, portions of systems, structures, and equipment which are not essential for the reliable generation of electricity and which do not contain radioactive material or whose failure could not result in the release of radioactive material.

The term "essential for the reliable generation of electric power" in the definition of Category II is interpreted to mean structures, systems and components, whose failure would result in a halt of electric power generation in about 8 hours or less.

The term "not essential for the reliable generation of electricity" in the definition of Category III is interpreted to mean structures, systems and components, whose failure would not result in the halt of electric power generation in about 8 hours or less.

The various structures, systems and components in the Beaver Valley Power Station which are QA Category I are listed in Table A.1-1.

A.2 DUQUESNE LIGHT COMPANY

Sections A.2.1 through A.2.1.18 describe the Duquesne Light Company Quality Assurance Program applicable during the design and construction of BVPS-1. For convenience, these sections are retained in the Updated FSAR as a history of the Quality Assurance Program. Therefore, they are substantially the same as the corresponding sections of the original FSAR.

A.2.1 Design and Construction Quality Assurance Program

Duquesne Light Company, the applicant, has established a quality assurance organization (Figures A.2-1 and A.2-2) to insure all the systems, components, and structures affecting the safety of the station are specified, fabricated, shipped, stored, installed, inspected, and tested in accordance with sound engineering principles. This includes the utilization of applicable codes, standards, specifications, procedures, and regulatory requirements. The Quality Assurance Program fulfills the requirements of Appendix B to 10CFR50.

This document summarizes the activities pertinent to quality assurance during the design, procurement, and construction phases of BVPS-1.

A.2.1.1 Organization

The Duquesne Light Company quality assurance organization consists of a Quality Assurance Department directed by the Quality Assurance Manager. Sufficient personnel are available to implement the Quality Assurance Program. All items pertinent to quality assurance are under his supervision.

The Quality Assurance Manager reports directly to the Vice-President, Nuclear Construction Division. The effort of the Quality Assurance Manager is directed solely to quality assurance. He purposely has no responsibility for project costs or project schedule considerations. This eliminates the possibility of such factors influencing his performance in quality assurance.

The Duquesne Light Company Quality Assurance Program provides written policies, procedures, and instructions governing the quality assurance activity. These are identified in the Duquesne Light Company Quality Assurance Program Manual. This manual details specific responsibilities for implementation of the program.

Duquesne Light Company personnel supporting the quality assurance effort include the Engineering and Construction Division and Power Stations Department. Engineers and others in these departments or sections fulfilling quality assurance responsibilities are directed by the Quality Assurance Manager.

The Quality Assurance Department is shown in Figure A.2-2.

The Quality Assurance Department personnel are aware of all quality matters pertaining to the project and assist with implementation of the total program. Their specific duties and responsibilities are delineated in the Duquesne Light Company Quality Assurance Program Manual.

The Duquesne Light Company Project Management Committee is chaired by the Vice-President, Engineering and Construction Division. Members of the committee include department heads from all engineering departments, the construction department, the purchasing department, plus the General Superintendent of Power Stations. The Quality Assurance Manager is a member of the committee and by charter is further designated as the secretary. Through this mechanism Duquesne Light Company management is cognizant of all quality assurance matters. The committee is also chartered to resolve impasses which may occur in quality matters. Meetings are conducted bimonthly or at the specific request of any member, as necessary. Minutes of the meetings are recorded and distributed to all members.

The Duquesne Light Company Project Team consists of a representative from each of the engineering disciplines assigned full-time to the project team office. They coordinate quality assurance activity between the field and their respective departments. This includes responsibility for making necessary contacts upon receipt of shop test notification, and to inform the quality assurance office of the decision to witness or waive a shop test. Further, project team members are responsible for the preparation and/or review of reports in accordance with the Duquesne Light Company Quality Assurance Program Manual.

The Duquesne Light Company Engineering Departments review and/or approve general design concepts, calculations, materials adequacy, specifications, bid evaluations, purchase requisitions, drawings, and correspondence in accordance with the procedures established as a result of the commitments in the Duquesne Light Company Quality Assurance Program Manual. They also assist in the implementation of the shop test program established as a result of the Duquesne Light Company Quality Assurance Manual and may upon request provide technical assistance in the audit program.

The Duquesne Light Company Construction Department maintains a full-time surveillance group at the site. Their activities are directed by the Chief Construction Inspector in accordance with a prescribed site surveillance plan. Any deviations or nonconformances discovered during the implementation of the Quality Assurance Program are transmitted to the Quality Assurance Manager for resolution. As a part of this site surveillance plan, the inspectors participate in the implementation of the Duquesne Light Company equipment clearance and tagging program and in conjunction with the Operations Department, inspect equipment and systems prior to final acceptance. Assistance is rendered in these activities by representatives from the Duquesne Light Company Engineering Departments who make frequent trips to the jobsite. Activities of the construction inspectors with regard to the Quality Assurance Program are identified in the Duquesne Light Company Quality Assurance Program Manual. In addition, a site surveillance program has been prepared which guides the overall activity of the construction inspectors at BVPS-1.

A.2.1.2 Quality Assurance Program

The Duquesne Light Company Quality Assurance Program conforms to the requirements of 10CFR50, Appendix B, Quality Assurance Criteria for Nuclear Power Plants. The Duquesne Light Company Quality Assurance Program Manual has been prepared and governs all quality assurance activities relating to this project. Implementation and assessment of this program is the responsibility of the Duquesne Light Company Quality Assurance Manager. Program implementation is discussed in Sections A.2.1.3 through A.2.1.18.

A.2.1.3 Design Control

The responsibility for the design control of BVPS-1 is delegated to S&W as agents for the Duquesne Light Company. This responsibility includes the review of interface design areas with the nuclear steam supply system to verify the adequacy. Similarly, Westinghouse Electric Corporation is responsible for the review of S&W design in the balance of plant to verify interface agreement with the nuclear steam supply system.

The Duquesne Light Company engineers review, on a selective basis, the design of certain components, systems, or structures. These reviews are documented on quality assurance checklists. Similar reviews are made of significant design changes which may occur during construction of the station.

Activities relating to design control are audited and documented in accordance with the provisions of the Duquesne Light Company Quality Assurance Program Manual.

A.2.1.4 Procurement Document Control

The procurement responsibility is delegated to S&W as the agent for the Duquesne Light Company. The Duquesne Light Company retains the right of approval for all vendors.

Approved vendors list developed on the basis of qualifications, previous experience, and/or evaluation surveys is maintained by S&W. This list is constantly updated. It is reviewed by the Duquesne Light Company to verify only qualified vendors being utilized in the procurement of components for BVPS-1.

In a similar manner Westinghouse maintains a qualified vendor list which is periodically reviewed by the Duquesne Light Company.

The Duquesne Light Company reviews and approves orders being placed with vendors. This review includes the specification, the purchase order, bid evaluation, and other documents pertaining to this activity. Categorization of components has been established by S&W identifying quality assurance levels to be specified. The quality assurance levels require review by the Duquesne Light Company and are audited periodically.

A.2.1.5 Instructions, Procedures, and Drawings

S&W is delegated the responsibility for preparation and distri- bution of specifications, drawings, instructions, and procedures in accordance with their manuals, instructions, and procedures. The Duquesne Light Company reviews such documents to assure safety, reliability, technical adequacy, and adherence to regulatory requirements and applicable codes. Reviews for safety-related equipment are documented on the appropriate quality assurance checklists. Instructions are contained in procedures established within Duquesne Light Company to prepare and report such reviews.

A.2.1.6 Document Control

Documents including drawings, instructions, procedures, specifi- cations, correspondence, etc., are controlled in accordance with the manuals of S&W and the Duquesne Light Company. Correspondence and other transmittals are maintained in document logs or by signed document receipts. The procedures establishing control and distribution of such documents are audited by S&W on a regular basis. In addition, the Duquesne Light Company provides for the audit of such documentation in accordance with the Quality Assurance Program requirements.

The manuals and procedures governing this activity also provide for review, and necessary revisions and/or additions to existing manuals or procedures.

A.2.1.7 Control of Purchased Material, Equipment, and Services

S&W, as agents for the Duquesne Light Company, are delegated the responsibility for the control of purchased material, equipment, and services. This is accomplished through source selection, progressive shop inspection, audits, witnessing of shop tests, and jobsite receipt inspection. The vendor requirements for control of material and equipment are verified for adherence to procurement requirements by the S&W Procurement Quality Control Inspectors. The Duquesne Light Company maintains control of these activities through audits of S&W and the vendor shops as necessary.

Periodic inspection and status reports are prepared by S&W Procurement Quality Control Inspectors and maintained by the Duquesne Light Company. Such information is utilized in the preparation of audit plans or to monitor continuing adherence to established procedures.

A.2.1.8 Identification and Control of Materials, Parts and Components

S&W, as agents for the Duquesne Light Company, are delegated the responsibility for the identification and control of materials, parts, and components. This includes activities in the vendor shops as well as site activities. The procedures governing S&W personnel in this activity assures that only specified materials are used. Reviews of vendors quality control programs and/or procedures are made to determine their (the vendors) exercise of control over materials, parts, and components, including partially fabricated assemblies. Such verification would include mill test certifications, review of the certifications against the specified codes, marking or otherwise identifying components, personnel qualifications, and similar requirements. Compliance with the activities required by this section are monitored at the site by the Duquesne Light Company and verified at the vendor shops or the S&W headquarters through the audit mechanism.

A.2.1.9 Control of Special Processes

S&W is delegated the responsibility for review and approval of welding, heat treating, nondestructive testing procedures, and other special processes utilized during the fabrication and erection of materials, parts, and components for BVPS-1. In addition, S&W maintains a welding procedure manual and similar documentation for the control of these processes at the construction site. Procedures from S&W and/or the vendors are reviewed for compliance with the applicable codes and the content of the specifications. S&W has established field quality control procedures to assure compliance with these provisions.

Qualifications of persons performing welding, nondestructive testing, and similar special processes where required by the specification are maintained by appropriate S&W personnel. These records are monitored and/or audited at the site by the Duquesne Light Company. Records in the vendor shops are included as part of the Duquesne Light Company audit program.

A.2.1.10 Inspection

The Duquesne Light Company has delegated the responsibility for implementation of an inspection program to S&W. This program assures that manufacturing, shipping, construction, installation, and testing activities are in accordance with the codes, specifications, drawings, and other governing documents. In the implementation of this program, S&W has established a Procurement Quality Control and Field Quality Control Division.

The Procurement Quality Control Inspectors are governed by the provisions of their manual, the specification, and drawings pertinent to the component. The inspector periodically visits the shop to verify compliance with the vendor's procedures and his adherence to the specifications. Equipment being procured from a vendor's shop is not released until the entire inspection program has been completed and documented. A shipping release tag system is provided to assure that all requirements have been met.

Material and components received at the site receive a similar inspection by the S&W Field Quality Control personnel. The instructions governing this inspection include receiving, storing, handling, installing, and preparing for operation. Acceptance criteria are identified in the drawing, the specification, the manufacturer's instructions, the codes, or in the field quality control manual.

The activities which may be in noncompliance with the prescribed activities at the site may be stopped by authorized personnel within the Duquesne Light Company and/or S&W Field Quality Control. In-process activity at the site provides specific instructions identifying hold points, visual examinations, nondestructive testing, welding procedure, and similar information. These activities are maintained in documented form in accordance with the governing manual.

Activity relating to inspection is audited by the Duquesne Light Company. In addition, certain selected shop tests are witnessed by the Duquesne Light Company engineers. Activities pertinent to witnessing of shop tests and/or audits are documented and maintained at the Quality Assurance Department office.

In a similar fashion the activities of the Duquesne Light Company Construction Inspection Department are documented and maintained at the site.

The Duquesne Light Company had delegated the responsibility for verification that all nondestructive testing, performance testing, installation testing, have been completed in accordance with specifications, procedures, and/or instructions. This responsibility includes provisions for assurance that the testing has been performed by qualified personnel and that documentation pertaining to the manner of testing, results of testing, and qualifications of personnel involved in testing are documented and maintained in the file.

A.2.1.11 (Deleted)

A.2.1.12 Control of Measuring and Test Equipment

During construction, the Duquesne Light Company has delegated the responsibility for the control of measuring and testing equipment to S&W. The specifications for BVPS-1 require manufacturer and material supplier control of calibration of tools, gages, instruments, and other measuring and testing devices. Compliance with these programs is verified by the S&W Procurement Quality Control Inspectors.

The above activities are audited by the Duquesne Light Company Quality Assurance Department.

Activity in the control of measuring and testing equipment including calibration records, calibration frequency, standards used for calibration, and other related information are included as part of the Duquesne Light Company audit and/or surveillance program both in the vendor shops and at the construction site.

A.2.1.13 Handling, Storage, and Shipping

S&W is delegated the responsibility for control of handling, storing, shipping, cleaning, and preservation of material and equipment. In accordance with the engineering instructions, specifications, and drawings, and governed by the provisions of the applicable manuals, the Procurement Quality Control and Field Quality Control groups assure compliance with the requirements.

Records of these inspections are maintained by the appropriate responsible organizations. Receiving inspection performed at the construction site is governed by written procedures and instructions. A tagging system is provided allowing for rapid and positive identification of material status. Environmental requirements as determined by the applicable documents are addressed as provisions made to assure compliance. Equipment and material placed in environmentally controlled storage is constantly monitored and recorded on equipment storage history cards. This program provides address to the requirements of this section through time of installation of the equipment.

The Duquesne Light Company maintains a constant surveillance of equipment and material in storage as well as a review of the documents pertaining to this program. The Duquesne Light Company audits address these characteristics in both vendor and site audits.

A.2.1.14 Inspection, Test, and Operation Status

During the procurement and construction phases, the responsibility for identifying status is delegated to S&W. This system includes utilization of stickers, tags, record cards, and checkoff lists as required. Tags indicating accept, reject, or hold are utilized to identify the status of the material. Mandatory hold points during fabrication are identified in appropriate procurement documents. The S&W Procurement Quality Control Inspectors, in accordance with established written procedures, verify the hold points.

During the procurement and construction phases, notifications regarding testing are identified to the Duquesne Light Company. Cognizant engineering personnel may elect to witness a test or waive a particular test. A log is maintained identifying this decision. Where tests are witnessed, a report is prepared by the cognizant engineers in accordance with the provisions of the Duquesne Light Company Quality Assurance Program Manual.

A.2.1.15 Nonconforming Materials, Parts, and Components

Nonconforming materials, parts, and components are controlled by procedures established by the Duquesne Light Company and S&W. These include controls in the vendor shops as well as at the construction site.

Nonconformance occurring during any activity attendant with the design, procurement, and construction phase requires review and disposition which may include rejection, repair, rework, or scrap, depending on the instructions contained in the documented procedure. Engineering personnel are included in the determination of disposition of such nonconforming material, parts, or equipment.

Vendors are required to maintain segregated areas for material identified as being nonconforming. At the jobsite, segregation areas are also provided to assure that nonconforming materials, parts, or components are not used pending final disposition.

The Duquesne Light Company maintains control of this activity through a surveillance and audit program. In addition to reviewing nonconformances reported by others, the Duquesne Light Company may generate nonconformance reports as provided for in the Duquesne Light Company Quality Assurance Program Manual.

A.2.1.16 Corrective Action

The Duquesne Light Company quality assurance requirements for corrective action are documented in written procedures. The Quality Assurance Manager or his designated representative may direct the stopping of all work pending corrective action. The Duquesne Light Company is also responsible for verification of a resolution of nonconformances or deviations. The Duquesne Light Company Quality Assurance Manager has the authority to prepare written notices to any participant in the Quality Assurance Program requesting changes and/or revisions to a program which may have resulted in the generation of repeated nonconformances. Conditions which may affect quality are documented and the corrective action is verified through the mechanisms provided in the Duquesne Light Company, S&W, and Westinghouse Manuals.

A.2.1.17 Quality Assurance Records

The official quality file for the BVPS-1 is maintained at the S&W Field Quality Control office. This file is monitored and audited by the Duquesne Light Company.

Included in the records maintained are purchase orders, drawings, specifications, correspondence, procedures, audit reports, minutes of meetings, quality assurance checklists, codes and standards, and similar material.

A file system has been established to assure retrievability of such records. In the case where records are not stored at the site, locations for storage are reviewed and/or approved by the Duquesne Light Company. Vendors retaining records for certain periods of time are instructed that such records must be submitted to the applicant at the conclusion of his (the vendor) storage responsibility.

A.2.1.18 Audits

The Duquesne Light Company retains the ultimate responsibility for Quality Assurance for BVPS-1. This responsibility is exercised mainly through an audit program. These audits are performed against the S&W and Westinghouse commitments. These include quality assurance/quality control procedures, specifications, drawings, instructions, and similar information. Internal audits of the Duquesne Light Company are also documented and maintained in the file.

As agents for the Duquesne Light Company, S&W also performs audits at the vendor shops through their Procurement Quality Control Division and audits at the site through the Field Quality Control Division. Both divisions are audited periodically by the Duquesne Light Company.

Audit reports are utilized to assess the adequacy of the Duquesne Light Company Quality Assurance Program. A record of all audits is maintained and periodically reviewed to assure necessary follow-up action. Audits are reported at each Project Management Committee Meeting to assure that the necessary level of management is involved and has an awareness of the audit program.

All audits are performed utilizing a preplanned checklist. The checklist will include address to the specific criteria of Appendix B of 10 CFR 50, results of previous audits, inspection reports, nonconformance reports, adherence to specifications, and other items as identified in the respective organization quality assurance manuals.

A.2.2 Operations Quality Assurance Program

Refer to the FENOC Quality Assurance Program Manual.

A.3 STONE & WEBSTER ENGINEERING CORPORATION QUALITY ASSURANCE PROGRAM (Design & Construction Phase)

Section A.3 describes the Stone & Webster Engineering Corporation Quality Assurance Program applicable during the design and construction phase of BVPS-1. For convenience, this section is retained in the Updated FSAR as a history of the program in effect during that phase of the project.

A Quality Assurance Program has been established by Stone & Webster Engineering Corporation (S&W) which ensures compliance with the intent of the Code of Federal Regulations, 10CFR50 - Appendix B, "Quality Assurance Criteria for Nuclear Power Plants," dated June 27, 1970.

This section summarizes the quality assurance measures established by S&W for application to Quality Assurance Category I items. Quality Assurance Category I includes those structures, plant systems, or portions of systems, and components whose failure or malfunction could cause a release of radioactivity that would endanger safety. This category also includes equipment which is vital to a safe shutdown of the plant and the removal of decay and sensible heat, or equipment which is necessary to mitigate consequences to the public of a postulated accident.

Quality Assurance Category I items are listed in the Duquesne Light Company Operations Quality Assurance Program.

A.3.1 Organization

A.3.1.1 General Description

Figure A.3-1, "S&W Quality Assurance Organization - Design & Construction Phase" shows the lines of authority, responsibility, and communication for quality matters within S&W.

Figure A.3-2, "S&W Quality Assurance Department - Design & Construction Phase" shows the lines of authority and responsibility within the Quality Assurance Department in Boston, at procurement inspection locations, and at construction sites.

Figure A.3-3, "S&W Quality Assurance Interrelationships - Design & Construction Phase" shows the lines of authority, communications, and responsibilities within the Quality Assurance Department in Boston, and with Procurement Inspection locations and at construction sites.

A.3.1.2 Establishment and Management of the Quality Assurance Program

The Vice-President, Quality Assurance, is responsible for:

1. Establishing the policy and program for quality assurance and quality control activities in all areas, except engineering and design

2. Coordinating all S&W quality assurance and quality control activities

3. Directing quality assurance and quality control activities for procurement and construction.

The Engineering Manager is a Vice-President and is responsible for:

1. Establishing the policy for quality assurance activities for engineering and design (hereafter referred to as engineering assurance activities)

2. Directing engineering assurance activities

3. Delineating applicable quality activities in engineering documents.

The Senior Construction Manager is a Vice-President and is responsible for compliance to quality requirements by construction activities.

The Manager of Projects is a Vice-President and has the prime responsibility for project costs and schedules.

The above mentioned Vice-Presidents report directly to the President and have authority delegated to them consistent with their area of management.

This organizational structure assures that the Vice-President, Quality Assurance, and the Engineering Manager are sufficiently independent of production pressures to properly carry out their responsibilities for directing and managing the Quality Assurance Program.

A.3.1.3 Management of Quality Assurance Activities

The Manager, Quality Assurance, is responsible for the administration and management of the S&W quality assurance program, with the exception of engineering assurance activities. He reports directly to the Vice-President, Quality Assurance.

The Chief Engineer, Engineering Assurance Division, is responsible for assuring the implementation and proper functioning of engineering assurance activities. He derives his authority from the Engineering Manager.

A.3.1.4 Implementing Organization

Quality requirements are established by the Engineering Department for materials, equipment, and construction activities, and are then included in specifications for their implementation. The Construction Department reviews specified quality requirements to ensure that effective implementation can be carried out. The quality assurance and quality control requirements in the specifications are reviewed and approved by the Quality Assurance Department.

Engineering assurance policy, established by the Engineering Manager, is documented in Engineering Assurance Procedures. Those Engineering Assurance Procedures which interface with quality control procedures are reviewed for concurrence by the Manager, Quality Assurance.

Quality assurance and quality control policy, established by the Vice-President, Quality Assurance, is documented in several manuals administrated by the Manager - Quality Assurance. These manuals and the persons assigned direct responsibility for their implementation are:

1. Project Quality Assurance Program Manual - Quality Assurance Coordinator

2. Field Quality Control Manual - Manager, Field Quality Control Division

3. Procurement Quality Control Manual - Manager, Field Procurement Quality Control Division

4. Quality Control Instructions - Manager, Field Quality Control Division/Manager, Procurement Quality Control Division

5. Company Quality Assurance Nondestructive Test Manual - Chief Engineer, Quality Assurance NDT Division.

The major areas of quality assurance activity within S&W are:

1. Engineering Assurance

2. Procurement Quality Control

3. Field Quality Control

4. Quality Assurance Nondestructive Testing

5. Quality Systems

6. Quality Assurance Coordination

7. Department Services.

Engineering Assurance

The Engineering Assurance Division (EA), with headquarters in Boston, is responsible for assuring the implementation and evaluation of the engineering assurance program, which consists of management systems for (1) control of technical work in engineering and design, and (2) assurance of quality of that work. Engineering Assurance also assures that completed engineering and design work conform to S&W procedures.

To fulfill these responsibilities, Engineering Assurance issues appropriate EAPs, provides continuing education in the engineering assurance program, audits engineering and design work, reports to management on the performance of engineering and design, and verifies the satisfactory completion of any required corrective action.

Quality Assurance

The Quality Assurance Department, with headquarters in Boston under the direction of the Manager - Quality Assurance, is responsible for implementing the policy and program, as established by the Vice-President, Quality Assurance. The quality assurance functions are carried out as follows:

Procurement Quality Control

The Procurement Quality Control Division (PQC) assures that suppliers conform to procurement specifications and drawings. The Procurement Quality Control Division, with headquarters in Boston, consists of a Manager and a staff of Engineers. District Offices and Resident Inspection locations are strategically located near major manufacturing centers in the United States. A District Chief directs each District Office and reports directly to the Manager, Procurement Quality Control.

Field Quality Control

The Field Quality Control Division (FQC) assures that erection and construction activities at the project site conform with procedures, specifications and drawings. The Field Quality Control Division, with headquarters in Boston, consists of a Manager, Assistant Manager, and an office staff of Senior Superintendents and supporting Engineers and Specialists. The project is staffed at the job site by a Field Quality Control Superintendent, Quality Control Engineers, inspectors, and field laboratory personnel. All site Field Quality Control personnel report to the Superintendent, Field Quality Control, who reports directly to the Manager, Field Quality Control, and are separate and independent from field and general office construction supervision.

Quality Assurance Nondestructive Testing

The Quality Assurance Nondestructive Test Division (NDT) provides assistance to the Procurement and Field Quality Control Divisions for Nondestructive Testing.

The Quality Assurance NDT Division, with headquarters in Boston, consists of a Chief Engineer, and a staff of qualified NDT engineers and specialists. The Quality Assurance NDT Division:

1. Prepares NDT procedures and technical instructions for field quality control use

2. Performs surveillance audits of NDT performed at the job site

3. Performs capability surveys of suppliers and contractors by reviewing test procedures and conducting audits

4. Develops and maintains proficiency of company NDT personnel by training, and by oral, written, and practical examination with American Society for Nondestructive Testing Recommended Practice SNT-TC-lA

5. Maintains laboratory facilities for development and validation of testing techniques for development and maintenance of test standards and for calibration of NDT related testing instruments.

Quality Systems Division

The Quality Systems Division (QSD) provides quality engineering support for the Quality Assurance Department activities, and is responsible for the establishment and control of quality systems. The QSD, with headquarters in Boston, consists of a Chief Engineer and a staff of Engineers and Specialists.

An integrated quality system is developed and controlled by methods, continuing education, technical support, and reports activities. Data analysis and reporting of S&W performance to management are provided to assure that the assigned efforts accomplish the intended function.

Quality Assurance Coordination

A Quality Assurance Coordinator is assigned to the Project, and is responsible for integrating all phases of the Quality Assurance Program. Under the direction of the Assistant Manager - Quality Assurance, he assists the projects group, including the Construction Manager and the Project Engineer, in implementing S&W quality assurance policies and programs. He acts as the Quality Assurance Department spokesman for the project, and assists the utility in quality assurance matters, when requested. He is responsible for coordinating quality-related interfaces between Duquesne Light Company, Westinghouse, and S&W, and for coordinating the Quality Assurance Sections of Safety Analysis Reports and their revisions. He assists with the Project Manager in quality assurance matters.

Department Services Group

The Department Services Group with headquarters in Boston, is assigned the responsibility for management audits, quality assurance cost monitoring, and support services within the quality assurance discipline. The group also provides administrative assistance within the department.

A.3.1.5 System and Authority for Stop-Work Action

S&W has a system for control of, and authority for, stop-work action for those items which do not conform to established quality requirements.

When a condition exists which is detrimental to plant quality, the FQC Engineer/Inspector, who observed or was notified of the condition, shall initiate a Rejection Report. He shall promptly transmit this information to the attention of the Superintendent of Construction or his designee. An inspector has the authority to stop work on an item he is responsible for when continued work would:

1. Cause damage

2. Prevent further inspection

3. Make remedial action ineffective.

A.3.1.6 Qualification and Experience Levels

Qualification and experience levels of management personnel carrying out the Quality Assurance Program are summarized in Table A.3-2.

A.3.2 Quality Assurance Program

A.3.2.1 General Description

The quality assurance program provides control of the S&W assigned activities throughout the following phases of the Project:

1. Conceptual design
2. Detailed engineering and design
3. Procurement
   a. Supplier selection
   b. Surveillance of suppliers' quality
   c. Witnessing tests
4. Installation and erection
   a. Contractor selection
   b. Field inspection activities
5. Preoperational testing.

The program includes planned and systematic actions that provide adequate confidence that structures, systems, or components required for safe and reliable plant operation perform satisfactorily.

A.3.2.2 Quality Assurance Program Documentation

The S&W Quality Assurance program policies, procedures, and instructions are documented in the five manuals listed below. These manuals are reviewed and approved by appropriate S&W management. All manuals and manual revisions are distributed as controlled documents to the key S&W personnel participating in project activities, and as requested by the Duquesne Light Company.

1. Project Quality Assurance Program Manuals - Prepared specifically for this project, outlining the project plan for quality assurance with organizational assignments of responsibility for program implementation
2. Field Quality Control Manual - Procedures for FQC operations available for use on this project consistent with the Project schedule of activities
3. Procurement Quality Control Manual - Procedures for procurement Quality Control Operations
4. Company Quality Assurance Nondestructive Test Manual - Procedures for nondestructive testing for Quality Control Operations

5. Engineering Assurance Manual - specified procedures for Engineering Assurance Operations.

Table A.3-2 illustrates the basic documentation of the major quality assurance areas of activity, and the procedural relationships to Appendix B of 10CFR50.

Quality Assurance Department and Engineering Assurance Division procedures require audits to assure compliance with program requirements, and include a "closed-loop" requirement to assure implementation of recommended corrective action.

A.3.2.3 Program Applicability

The S&W Quality Assurance Program for the design and construction phase of BVPS-1 was applied to the Duquesne Light Company Quality Assurance Category I items, listed in Table A.1-1 of the original FSAR.

A.3.2.4 ndoctrination and Continuing Education

Continuing education and qualification of personnel performing quality-related activities are requirements of the Quality Assurance Program. Quality Assurance Department personnel responsible for nondestructive testing are trained and qualified in accordance with the applicable requirements of SNT-TC-IA, "Recommended Practice for Nondestructive Test Personnel Qualification and Certification" of the American Society of Nondestructive Testing. This program is administered by instructors from the Quality Assurance NDT Division and Quality Systems Division.

Other continuing education programs, related to quality, are conducted for Engineers, FQC personnel, and Construction Supervisors.

A.3.2.5 Periodic Review of Quality Assurance Program

The status and adequacy of the quality assurance manuals are regularly reviewed and assessed. Periodic management level audits are conducted to assure the implementation of Quality Assurance Program requirements, and to upgrade the program to reflect applicable Code, Standard, and regulatory requirements.

A.3.3 Design Control

A.3.3.1 General Description

Measures are established to assure that applicable requirements and nuclear power plant design bases are correctly translated into S&W specifications, drawings, procedures, and instructions.

The essential elements required to implement design control, and to validate the adequacy of this control, used by Engineering Assurance are:

1. Establishment of the basic methods of scoping, accomplishing, and documenting the completeness of essential engineering and design tasks.

2. Reviewing and checking of designs, calculations, specifications, and drawings by competent technical personnel.

3. An assurance program to assure compliance, through assessment of conformance, to procedures, and documented by objective evidence.

A.3.3.2 Design Standards

Design documents and specifications for structures, plant systems or portions of systems, and components are prepared and reviewed for the following:

1. Engineering requirements

2. AEC General & Design Criteria conformance

3. AEC Regulatory Guides and/or Information Guides applicability

4. Industry Codes and Standards

5. Safety Analysis Report conformance

6. Quality Assurance requirements and adequacy

7. Interface requirements between S&W and Westinghouse.

Deviations from the above are documented, investigated and resolved.

A.3.3.3 Design Reviews

Numerous internal design reviews are conducted through the engineering and design phase by qualified technical personnel, including the Project Engineer, engineering specialists, and lead project discipline engineers.

Formal audits have been conducted by Engineering Assurance to assure compliance with the design review process.

A.3.3.4 Design Control and Change Control

Designs are subjected to engineering reviews and checks as described below.

Design

Engineering/design documents are reviewed and approved by at least one other engineer, in addition to the individual primarily responsible for preparation. Engineering reviews include both the original document and any subsequent revisions.

Design Criteria Documents

Design criteria documents are reviewed and approved by cognizant engineers and the Project Engineer. The following items are considered in these reviews:

1. Postulated accident analysis
2. Compatibility of materials
3. Compatibility of design interfaces with the NSSS and others
4. Accessibility for inservice inspection, maintenance, and repair
5. Acceptance criteria for tests and inspection
6. Quality requirements.

Engineering Calculations

Manual calculations are reviewed and signed by a qualified person, in addition to the preparer. The review consists of a check of original assumptions, correct methods, accuracy, and final conclusions.

Machine calculations are prepared with a summary sheet, including all pertinent design criteria and other design input and results, e.g., curves, tables, etc. Machine calculation input data, summary sheets, and data printout sheets are reviewed by a qualified person in addition to the originator, and are signed by the originator and reviewer. The Engineering Assurance Manual establishes the requirements for the preparation, review, and filing of all engineering calculations.

Calculations may be checked by an alternate or simplified calculational method as appropriate, with review and signature approval as above.

Specifications

Specifications, after preparation, are reviewed and approved by the lead engineer, specialist, project engineer, quality assurance, materials engineer, and construction department as applicable.

Drawings

After a drawing is prepared, it is thoroughly reviewed by a designer other than the preparer. Review of the initial and all subsequent issues is for adherence to standards, supporting calculations, engineering instructions, compatibility with other drawings, and correctness of dimensions. The drawing is then examined and initialed by other design disciplines having an interface. Review and approval are also provided by the design supervisor, the responsible engineer, the Project Engineer or his designee, and, when required by Code, Regulation, or law, it is signed and, as required, stamped by a registered professional engineer.

Design Interfaces

Design interfaces include those between contractors and between engineering disciplines. Interface review is a specific check in the specification and drawing review and approval cycle (see above).

Specific procedures in the Engineering Assurance Manual provide written instructions governing the review, approval, release, distribution, and revision of documents involving design interfaces with the participating design organizations, including those with Westinghouse.

Design Audits

Audits are conducted by the Engineering Assurance Division to measure performance and compliance with establishing procedures. Formal reports are issued to management for each audit, noting any required corrective action.

Prototype Testing Control

If prototype testing is required to confirm design adequacy, the testing, acceptance criteria, and documentation requirements are contained in the specifications or other applicable engineering documents.

Design Change Control

All technical changes to approved procedures, instructions, calculations, drawings, and specifications are permitted only after review by the same organization and in the same manner as the original document. Engineering Assurance Procedures prescribe the method of authorizing shop or field work resulting from an engineering or design change which must precede revision of the approved review and approval of changes to said documents by the originating organization.

A.3.4 Procurement Document Control

A.3.4.1 General Description

Engineering, design, quality, and any other requirements necessary to assure proper item performance are specified in the specifications for materials, equipment, and services. Control of incorporation, review, and approval of quality assurance and quality control requirements in procurement specifications is maintained by using procedures in the various S&W Quality Assurance Manuals.

A.3.4.2 Headquarters Purchased Items

Quality assurance and quality control requirements are included as part of the procurement document. S&W written procedures require review of and concurrence by the Quality Assurance Department for Quality Assurance Category I specifications. The reviews are for consideration and applicability of:

1. Codes and Standards, including proper identification

2. Quality Assurance Program requirements

3. Test requirements by suppliers and erectors

4. Inspection requirements by suppliers and erectors, and inspection requirements and rights of entry by S&W inspectors and/or Duquesne Light Company inspectors

5. Nondestructive testing requirements

6. Records and documentation requirements.

A.3.4.3 Field Purchase Items

For field purchases, a Field Purchase Requisition is initiated and completed by the Superintendent of Construction or his designee. The requisition indicates the specification, drawing or other design document (when applicable) from which the data was extracted, and the Quality Assurance Category. The quality assurance and quality control requirements in the Field Purchase Requisition are reviewed and approved by the Superintendent of FQC or his designee before forwarding to Field Purchasing, in accordance with field Quality Assurance Procedures.

A.3.5 Instructions, Procedures, and Drawings

A.3.5.1 General Description

The Quality Assurance Program manuals document the policy, procedures, and instructions for the administrative and quality-related inputs to documents affecting the quality of Quality Assurance Category I structures, systems or portions of systems, and components. Appropriate quantitative and qualitative acceptance criteria for determining that quality-related activities have been satisfactorily accomplished are contained in instructions procedures, specifications, drawings, or other appropriate documents.

A.3.5.2 Procedures and Manuals

The Stone & Webster Quality Assurance Program is documented by written procedures contained in the supporting quality assurance manuals referenced in Section A.3.2 and further detailed in Table A.3-1.

A.3.5.3 Codes and Standards

Methods and procedures for determining the effective dates of Codes and Standards are outlined in the Engineering Assurance Manual and are in conformance with the Code of Federal Regulations 10CFR50.55a.

A.3.5.4 Reporting Significant Deficiencies

The policy and methods for complying with the Code of Federal Regulations 10CFR50.55e in Reporting of Significant Deficiencies to the AEC are contained in the Engineering Assurance Manual.

A.3.5.5 Authorized Engineering and Design Changes

The Engineering Assurance Manual outlines authorized methods to change specifications or drawings. They are:

1. Revisions of the drawing, by issue of an addendum to specification

2. An approved disposition to Nonconformity and Disposition Reports (N&DR)

3. Authorization for change by an Engineering and Design Coordination Report (E&DCR).

A.3.6 Document Control

A.3.6.1 General Description

Procedures for implementing document control measures are contained in the S&W Quality Assurance Program Manuals. These procedures control the issue of documents such as specifications and drawings, including authorized changes thereto, and assure that the documents and revisions are reviewed for adequacy and approved for release by authorized personnel.

A.3.6.2 Review and Approval of Documents

Stone & Webster specifications and drawings, including revisions thereto, are prepared, reviewed, and approved according to procedures outlined in the Engineering Assurance Manual. Similar procedures govern the review of supplier's drawings, and revisions thereto, to assure compliance with specification requirements, if review is required by the specification.

The FQC Division inspects actual field work performed to the requirements of revised drawings and Engineering and Design Coordination Reports to verify that work performed is in accordance with the current revision.

A.3.6.3 Controlled Distribution and Use

Distribution to and use at the location by the designated responsible authority are carefully controlled by means of document logs, signed document receipts, and audited by responsible personnel. Written procedures in the Field Quality Control Manual govern the removal and disposal of obsolete drawings from the construction site work areas.

A.3.7 Control of Purchased Material and Equipment

A.3.7.1 General Description

The quality of Quality Assurance Category I purchased material and equipment, is controlled, as an example but not limited to: source evaluation and selection; inspection at vendor's shops; witnessing of shop tests; audits of quality assurance/quality control systems and documentation; and jobsite receiving inspections.

A.3.7.2 Control Methods

When required, vendors' quality assurance capabilities are assessed by the PQC Division to determine their suitability to bid on Quality Assurance Category I items. The assessment is based on evaluation of past performance, surveys at the vendors' facilities, surveillance and audits, as appropriate to the complexity of the item. A PQC Survey Form and Supplement are used for bidder surveys and to document survey findings. Project engineering establishes the quality requirements in procurement specifications consistent with the functional importance and complexity of the individual item or system.

A.3.7.3 Source Evaluation and Selection

The principal method of collecting information on prospective suppliers of specified items of materials and equipment is the "Vendor Quality Control Survey System." Provisions of this system, as outlined in the Procurement Quality Control Manual, Engineering Assurance Manual, and Quality Assurance Program Manual, provide source evaluation information for use by the Quality Assurance, Engineering, and Purchasing Departments.

Bids are compared on a technical and commercial basis to determine compliance with specifications and intended use. Comparisons of bids for major items are reviewed by the Project Group and the Purchasing Department before recommendation of award of a purchase order or contract is made. This project review includes a review by the Quality Assurance Coordinator to assure that no exception to quality requirements have been made.

Bidders Quality Assurance Programs for Quality Assurance Category I items are reviewed and evaluated by the PQC Division in parallel with the technical and commercial comparison of bids.

A.3.7.4 Inspections at Vendors

Inspections and/or audits are performed at Seller's shop by properly qualified S&W personnel to assure that the requirements of the purchase order, specifications, approved shop drawings, and all specified Codes and Standards are met. Specific instructions regarding inspection activities and a summary of these activities are given in the specification. The S&W "Vendor Shop Quality Control Inspection System" and the specific "Duties and Responsibilities of Inspectors" are given in the Procurement Quality Control Manual.

A.3.7.5 Site Receiving Inspection

Upon delivery at the construction site, appropriate examination of materials and equipment is performed under the direction of the Superintendent of FQC by his staff in accordance with procedures.

A.3.7.6 Quality Documentary Evidence

Specified quality records are checked upon receipt and verified for completeness, accuracy, and traceability.

A.3.8 Identification and Control of Materials, Parts, and Components

A.3.8.1 General Description

The program ensures that only specified materials are used. This assurance is gained by established methods for proper identification and control of materials, parts, and components, including partially fabricated assemblies. These methods include, as applicable, traceability to chemical and physical markings, comparison of material test reports against specified Code requirements, maintenance of identification through production phases by marking, tagging, or other means such as labeling, identification plates, color plates, color coding, etc.

Traceability requirements of Quality Assurance Category I items to their original chemical and physical characteristics are identified in the procurement specification and by reference to the requirements of applicable Codes and Standards. Traceability, when required, is maintained by quality-related documentation and/or by a physical marking system.

A.3.8.2 Materials, Parts, and Components

Where required, parts and components are identified by individual mark numbers or serial numbers to permit traceability to chemical and physical test reports and other quality documentation prepared by the manufacturer in compliance with Code and specification requirements.

General construction materials, such as reinforcing steel, random pipes, bolts, etc., are approved for use by the lot-acceptance and physical marking methods. Material test reports for each heat of material within a given lot are checked for compliance with requirements of specifications. A random sampling is made to assure that the reports examined are traceable to the material in the lot. The lot is released for use when the material is found to be acceptable by the Quality Control Inspector. Identification of lot-accepted materials is maintained, when required, by physical marking. For example, a color coding system is used for identifications of an accepted lot of random pipe, which identifies the ASTM/ASME designation, type, and pipe wall thickness. Certain power and control cables are similarly color coded for identification.

Mark numbers and similar identification coding assigned to items are used for identification purposes on drawings, specifications, correspondence, and reports concerning the item of equipment, and are maintained from start of design, through manufacture, shipping, installation, operation, maintenance, and throughout the life of the item.

A.3.8.3 Identification and Control at Site

The Superintendent of FQC is responsible for assuring the identification, classification, and segregation of all conforming materials and components at the job site by periodic audits. A system of tagging and physical segregation (when practicable) of nonconforming items is used at the construction site. Records of the disposition of nonconforming items become a part of the site quality assurance file.

A.3.9 Control of Special Processes

A.3.9.1 General Description

Control of special processes (as an example but not limited to: welding, heat treating, protective coating, Cadwelding, and nondestructive testing) is maintained by:

1. Specifying the requirements in detail, or by requiring fabricators or subcontractors to submit their procedures for S&W approval

2. Appropriate shop/site inspection/audits.

A.3.9.2 Welding

Welding procedure specifications are prepared by the S&W Materials Engineering Division, qualified in accordance with applicable codes and standards and used for erection work performed by S&W. Quality assurance personnel review these procedures prior to their issue and use at the construction site.

The procedures contain sufficient information pertaining to codes, standards, and methods of testing so that quality control activities can be properly performed. The FQC Division is also responsible for verifying weld procedure and welder qualification. For erection work performed by others, the welding procedures to be used are submitted to the Materials Engineering Division for review. Supplier's and subcontractor's welding procedures are submitted for review when required by the specification.

Welders and welding operators at fabrication shops and construction sites must be qualified to applicable requirements. At the construction site, the Superintendent of FQC has the authority to require a retest of any welder or welding operator as indicated in the FQC Manual. Welders' and welding operators' certifications are issued by FQC and copies maintained in the site quality assurance file.

The control of special processes includes documentation of welding by welder, date, procedure, inspection performed, and records of preheat, post heat, and stress relief. These records are used to assure that all requirements have been met.

A.3.9.3 Nondestructive Testing

Nondestructive test examinations and personnel performing these examinations are controlled by requirements given in S&W specifications and in the Company Quality Assurance Nondestructive Test Manual.

Manufacturer's personnel performing nondestructive testing must be qualified in accordance with applicable requirements. Manufacturer's procedures are submitted to Stone & Webster for approval prior to use. Qualification certifications and the results of such tests are reviewed and verified by S&W Quality Control Inspectors in vendor's shops and at the construction site.

The FQC Division personnel witnessing and/or performing nondestructive test examinations at the construction site are qualified in accordance with the ASME Boiler and Pressure Vessel Code, Section III, and the American Society of Nondestructive Testing, Recommended Practice, SNT-TC-lA.

Nondestructive testing procedures are documented in the S&W Quality Assurance Nondestructive Test Manual. Acceptance standards for noncode components are established by the Materials Engineering Division.

A.3.9.4 Cleaning and Flushing of Components and Systems

Cleaning requirements for manufactured components are specified in the S&W specification when required. Systems cleaning and flushing procedures are prepared by S&W for those components under its control. Field cleaning and flushing procedures for systems under the control of Westinghouse are reviewed and evaluated by Stone & Webster. Quality Assurance Department concurrence is also required as part of the specification review cycle. Performance and acceptance criteria are included in the specification.

A.3.10 Inspection

A.3.10.1 General Description

Inspections are performed in suppliers' shops by Procurement Quality Control Inspectors in accordance with the Procurement Quality Standards Manual. Field inspections are conducted by FQC Engineers and Inspectors in accordance with the Field Quality Control Manual. Inspection requirements are stated in specifications and procedures.

A.3.10.2 Procurement Quality Control Inspection

Procurement Quality Control inspection requirements are contained in the procurement specification and summarized as a verification checklist on a specification for Quality Assurance Category I equipment. The inspection detailed is defined by Codes, Standards, and the specification itself. The shop inspections and designated tests are performed by the manufacturer's personnel charged with the quality responsibility and these inspections are witnessed or verified by the S&W PQC Inspector as required. In addition to the specified tests, the PQC Inspector may be instructed to perform examination of large lots of material on a sampling basis. Equipment is not released for shipment until the summary of inspections is properly completed.

A.3.10.3 Field Quality Control Inspection

Material and components are inspected on receipt at the construction site. Field quality control personnel perform inspections of material and components during receiving, storage, handling, installation, and preparation for operation. The activities inspected and the criteria for acceptance are shown on approved drawings, specifications, manufacturer's special instructions, and in supporting procedures and instructions. Inspections and nondestructive tests are specified and performed where necessary to assure quality. Specific hold points when appropriate are included in the specification or are established by FQC to implement their responsibilities as outlined in the FQC manual.

The Superintendent of FQC is responsible for assuring that the field inspection requirements have been met in the following construction activities:

1. Soils identification and control of moisture and compaction

2. Inspection of concrete forms, reinforcing steel, electrical, mechanical, and structural embedments prior to concrete placement

3. Verification of proper proportioning, mixing, and delivery of concrete

4. Inspection of structural steel erection and bearing pile installation, if applicable

5. Nondestructive examination of welding

6. Inspection for proper assembly of piping systems and components

7. Alignment and clearance of mechanical equipment

8. Verification of electrical cable routing, termination, and equipment installation

9. All other Quality Assurance Category I work not specified above.

Field piping fabrication and erection operations on Category I systems and equipment receive inprocess and final quality control inspections for assurance that the requirements of specifications and approved drawings are met. The inspections specified are documented and maintained at the construction site in the site quality assurance file.

A.3.11 Test Control

A.3.11.1 General Description

Stone & Webster requires that shop, field installation, and pre-operational tests be specified and performed to ensure that structures, systems, or portions of systems, and components perform satisfactorily in service. Tests are controlled by specification and procedure requirements.

A.3.11.2 Test Requirements

Test requirements are set forth in procedures and specifications in accordance with engineering practices and Code requirements. Tests required by Codes and Standards are conducted and their results documented.

A.3.11.3 Shop and Field Test Control

The required testing of materials and components at vendors' and suppliers' shops is accomplished, identified, and performed in accordance with written test procedures that have been reviewed and evaluated by Stone & Webster.

Test results are reviewed to verify that tests have been performed in accordance with specified procedures and the results are within acceptance limits. Any deviations or questionable shop test data are reviewed by project engineering and instructions are issued for disposition in accordance with procedures for handling nonconforming material or components.

The Superintendent of FQC is responsible for assuring that all site quality control tests specified are performed in accordance with specifications and procedures.

An advisory Operations Engineer and a group of plant startup specialists are assigned by S&W to the construction site to act in an advisory capacity to the Duquesne Light Company during preoperational testing activities. Preoperational test procedures are prepared by Duquesne Light Company with the assistance of S&W, Westinghouse, and major equipment suppliers.

A.3.12 Control of Measuring and Testing Equipment

A.3.12.1 General Description

Stone & Webster specifications require that manufacturers and material suppliers control the calibration of tools, gages, instruments, and other measuring and testing devices used in activities affecting product quality on designated items. Verification of such control is made by the S&W Procurement Quality Control Inspector. Control over measuring and testing devices used by S&W and contractors and subcontractors at the construction site is implemented by the written procedures. These procedures require that the calibration and proper adjustment of measuring and testing devices be accomplished at established periods and against certified measurement standards that are traceable to the National Bureau of Standards (NBS) when available.

Identification of, and calibration records for, testing and measuring equipment used in final acceptance inspection are established so that equipment can be readily recalled for recalibration or adjustment.

Contractors' calibration policy, schedule, and system for the control of measuring and test equipment is detailed in their applicable Quality Control Manual. These procedures are reviewed for adequacy by S&W. The Superintendent of FQC is responsible for auditing construction/contractor adherence to these procedures.

A.3.12.2 Calibration Standards

All calibrations are in accordance with manufacturer's instructions, codes and standards, specifications, or Stone & Webster instructions and are made against certified measurement standards that have known valid relationships to NBS standards when available.

A.3.13 Handling, Storage, and Shipping

A.3.13.1 General Description

Preservation of the quality of Quality Assurance Category I materials and equipment is maintained by implementation of procedures and/or instructions for prepackaging, cleaning and preparation identification, caution marking, protection against weathering, corrosion damage, and undue stressing.

A.3.13.2 Instructions and Procedures

The procurement specification details special requirements for handling, storage, and shipping, when required. Inspection of packaging and preparation for shipment at the manufacturer's shop are performed as appropriate.

Documented receiving inspection is performed at the construction site by field quality control personnel in accordance with established procedures and instructions. Material status is clearly shown by a tagging system. The storage of plant equipment and/or material is controlled to assure the quality is not impaired during the storage period. Materials are placed in a proper state of preservation prior to storage. The four classes of storage used are:

1. Special Environment
2. Inside Heated
3. Inside (includes inside unheated and outside protected)
4. Outside.

The special environment class provides for special protection such as inert gas blankets, humidity level control, etc., where applicable. All storage areas are inspected by and any nonconformance or protection degradation is corrected. The field quality control storage program is continuous from receipt until the material is released for preliminary operation.

A.3.14 Inspection, Test, and Operating Status

A.3.14.1 General Description

The Quality Assurance Program provides measures for indicating the status of tests and inspections performed on materials, parts, and components, and the operating status of structures, systems, and components.

A.3.14.2 Inspection and Test Status System

The status of an item is indicated by means of stickers, tags, equipment record cards, FQC preoperational test records, and checkoff lists. Inspection and test status are defined in three general categories described below:

1. ACCEPT: Materials, parts, and components which are inspected and found satisfactory, and in conformance with applicable specifications. This status is recorded and only accepted materials, parts, and components are released for use to warehouse facilities, storage areas, or fabrication and erection areas.
2. REJECT: Materials, parts, and components which are inspected and found unsatisfactory, and not in accordance with applicable specifications. This status is recorded, and rejected items are tagged or segregated to a controlled reject area until such time that a disposition is made. If segregation of rejected materials is not practical, the items are physically tagged to clearly show status.
3. HOLD: Materials, parts, and components that have been received at the receiving inspection area and are awaiting: inspection, identification, or documentation.

The HOLD status is identified on a written record and the item is appropriately tagged, where practical. Such items are physically segregated (where practicable) from accepted items until a disposition of the HOLD status is made.

A.3.14.3 Preoperational and Operating Status

Procedures for the turnover of systems and components to the plant operating personnel are mutually established by the Duquesne Light Company and S&W. S&W Field Quality Control activities are complete when final acceptance is provided by Duquesne Light Company. Preoperational testing and plant operation are accomplished by the Duquesne Light Company operating personnel in accordance with written procedures prepared by the Duquesne Light Company.

A.3.15 Nonconforming Materials, Parts, and Components

Measures are taken to control nonconforming material, parts, or components. Materials, equipment, and workmanship deviating from approved specifications, codes, plans, or other applicable documents are considered nonconformances and are controlled in order to prevent their inadvertent use in fabrication and/or installation. The control of nonconformance is detailed in written procedures which describe specific identification, documentation, segregation, disposition, and notification requirements. Nonconformances discovered during any phase of engineering, manufacturing, fabrication, shipment, receipt, storage, installation, construction, or testing are reviewed and accepted, rejected, repaired, reworked, or scrapped in accordance with documented procedures.

Procedures reference the individuals' and groups' responsibility for assigning dispositions to those nonconformances that can or cannot be corrected or can be accepted as is to meet the specified requirements.

A.3.15.1 Nonconformities at Vendor Shops

A nonconformity discovered in a vendor's shop by a PQC Inspector, which requires an S&W engineering resolution, is reported on his Inspection Report and recorded on a Nonconformity and Disposition Report. These reports are sent to the PQC Division and the Project Engineer in accordance with the Procurement Quality Control Manual.

A.3.15.2 Nonconformities at Construction Site

Written procedures in the Field Quality Control Manual detail the Stone & Webster system of documenting, disposing of, and controlling nonconforming items. If a deficiency can be corrected within the scope of the specification requirements, the disposition may come from the Resident Construction Manager or the Resident Engineer. These conditions are reported and dispositions indicated on Nonconformance and Disposition Report.

If the deficiency cannot be resolved to meet the specification or requires a special repair procedure, a Nonconformance and Disposition Report is written and forwarded to project engineering for disposition.

The nonconformance is considered closed when the required disposition has been accomplished and reinspection verifies that adherence to disposition requirements have been met. The N&D is then signed by the Superintendent of FQC or his designee and entered in the site quality assurance file.

A.3.16 Corrective Action

A.3.16.1 General Description

For those Nonconformance and Disposition Reports, as described in Section A.3.15, where corrective action is required, the individual corrective action is assigned in most cases by those individuals or groups who organizationally are responsible for preventing recurrence.

Nonconformance and Disposition Reports issued for shop and field nonconforming items are reviewed by the Quality Assurance Department for conditions adverse to quality and to control recurring discrepancies.

The Project Quality Assurance Coordinator is responsible for follow through of corrective actions resulting from internal project audits and from AEC and Duquesne Light Company audits.

A.3.16.2 Recurrence Preventive Action

Feedback information on nonconformities is transmitted from shop and field to headquarters and collected using a computer program. The data are analyzed and evaluated by quality assurance personnel, after which corrective action is recommended to assist in controlling and preventing recurrences of nonconformances.

In accordance with procedures in the Engineering Assurance Manual, significant conditions adverse to quality in engineering, design, and construction are documented in Problem Reports, which include the cause and the corrective action taken. These Problem Reports are sent to appropriate levels of management and to those individuals or groups responsible for developing and implementing preventive action. Audits are conducted to access the effectiveness of this system for management evaluation. The EA Manual also implements a comprehensive feedback system for communicating information concerning problems or abnormal experiences at both S&W facilities and other facilities. This feedback system includes the review of government and industry published literature for potential problems related to power plant engineering, design, construction, and quality assurance. The information developed from this review is published for information and/or action to assure appropriate action is taken to prevent occurrence (or recurrence) of the problem.

A.3.16.3 Reporting Significant Deficiencies

The EA Manual gives the policy and methods for complying with 10CFR50.55(e) (Reporting of Significant Deficiencies to the AEC).

A.3.17 Quality Assurance Records

A.3.17.1 General Description

The S&W project quality assurance records system are defined in procedures, instructions, and in procurement and erection specifications. Procedures and instructions govern the general and specific requirements, development, transmittal and receipt, checking, storage, retrieval, and disposition of quality control and quality assurance records.

The records system includes those records which define a design feature or provide evidence of the accuracy and proper execution of engineering design, quality assurance, construction, and testing. These documents include, but are not limited to: calculations, drawings, specifications, procedures, purchase orders, inspection and nondestructive testing records, and records of preoperational and operational tests.

A.3.17.2 Quality Assurance Records Requirements

Specific records requirements are identified in procurement, erection, and test specification, and include records of the results of reviews, inspections, tests, audits, monitoring of work performance, and qualification of procedures. Records requirements associated with equipment and components are summarized on the Test, Inspection, and Documentation Report Form (TID) or equivalent which is part of each Quality Assurance Category I procurement and erection specification.

Procedures included in the Quality Manuals provide instructions on the preparation of quality-related records, the handling and documentation of nonconformances in the shop and field, and the review of quality control and quality assurance records by responsible authority.

A.3.17.3 Engineering and Design Records

Engineering and design records consist basically of engineering studies, calculations, designs, specifications, and drawings. Documents generated during the engineering and design phases of the project are generally retained in the project files and at designated work locations at headquarters in Boston until job completion.

Engineering and design records which become part of the lifetime or nonpermanent records retention system for the plant are properly identified and forwarded to the Duquesne Light Company for entry into the records retention system at a mutually agreed upon time toward the end of project.

A.3.17.4 Installation and Construction Records

During the construction period, the Superintendent of FQC establishes and maintains a site Quality Assurance file on site. This file contains all final quality-related documentation as identified in the Field Quality Control Manual. Records in the site quality assurance file are retained for the duration of the construction phase. Duquesne Light Company will advise S&W of its record needs and these records will be transferred to the Duquesne Light Company for the operational phase.

Detailed quality-related records and information, generated by contractors and subcontractors, are entered into the site quality assurance file. FQC personnel audit records requirements imposed on jobsite contractors and subcontractors.

A.3.17.5 Collection, Storage, and Maintenance of Quality Assurance Records

Requirements for the collection, storage, and maintenance of records are established by procedures which are consistent with applicable codes and standards, regulatory requirements, and other requirements that may be established by the Duquesne Light Company.

A.3.18 Audits

A.3.18.1 General Description

The Quality Assurance Program provides for planned audits that verify compliance with the quality-related requirements specified for the project. Audits aid in ensuring proper and timely implementation, compliance, and consistency in the discharge of assigned responsibilities.

The frequency of quality assurance audits is based on the results of previous audits, significance of reported nonconformances, and schedules of work accomplishment.

Audits are performed in accordance with written procedures and audit plans by engineering assurance, quality control, and quality assurance personnel who, by the nature of their position, are independent from the work functions being audited.

The audits program encompasses quality-related activities in the following areas:

1. Control of engineering designs, specifications, and drawings, including authorized changes thereto
2. Control of suppliers' quality
3. Materials control
4. Manufacturing processes and controls
5. Measuring and test equipment
6. Inspection and test control
7. Records of inspections
8. Control of nonconformities and dispositions
9. Control of special processes
10. Handling and storage of equipment
11. Construction and erection activities
12. Quality assurance and quality control records
13. Conformance to requirements of the applicable quality assurance manuals
14. Conformance to Safety Analysis Report commitments.

A.3.18.2 Quality Assurance Program Audits

The requirements for conducting Quality Assurance Program audits of quality-related activities are detailed in the project quality assurance program manual listed in Section A.3.2.2.

A.3.18.3 Audit Results and Reports

Audit results are documented and reviewed by management having responsibility in the area audited.

When necessary, recommendations and corrective actions are outlined in the audit reports. Engineering assurance, quality control and quality assurance auditors follow-up those recommendations and assigned corrective actions in order to determine their effectiveness. The results of follow-up actions are also reported to management and those directly concerned.

A.4 WESTINGHOUSE PRESSURIZED WATER REACTOR SYSTEMS DIVISION QUALITY ASSURANCE PLAN (Design & Construction Phase)

Section A.4 describes the Westinghouse Pressurized Water Reactor Systems Division Quality Assurance Plan applicable during the design and construction phase of BVPS-1. For convenience, this section is retained in the Updated FSAR as a history of the program in effect during that phase of the project.

A.4.1 Purpose

This plan describes the Westinghouse Pressurized Water Reactor Systems Division Quality Assurance (QA) Program for the Nuclear Steam Supply System (NSSS). Its purpose is to describe the procedures and actions used by Westinghouse to assure that the design, materials, and workmanship employed in the fabrication and construction of systems, components, and installations within the Westinghouse scope of responsibility in a nuclear power plant are controlled and meet all applicable requirements of safety, reliability, operation, and maintenance.

This plan is a requirement for, but it is not necessarily limited to, those components and systems of the plant having a vital role in the prevention or mitigation of the consequences of accidents which can cause undue risk to the health and safety of the public.

The quality plan is structured to provide, first a statement of quality assurance philosophy followed by an overview of the Quality Assurance Program. Sections A.4.3.1 through A.4.3.18 address each of the Quality Assurance Criteria, 10CFR50, Appendix B. For each criterion, the measures employed are described in sufficient detail to allow the reader to understand the Quality Assurance Program.

A.4.2 Philosophy and Overview

The Nuclear Energy Systems (NES) philosophy on quality assurance is to provide reliable, high quality products. This philosophy has existed since Westinghouse began furnishing nuclear plant services and equipment.

Written administrative and technical policies, procedures, and instructions are in use in Westinghouse to implement the Quality Assurance Program. They are in formats appropriate to their applications.

Technical and contractual information to assure effective implementation of these policies and procedures is developed, documented, and controlled. Procedures are reviewed and revised on a continuing basis by the issuing authorities so that the procedures meet the needs for which they are intended. Management reviews performance in accordance with these procedures to ensure compliance. Independent audits, as described later, provide objective assurance of both the adequacy of the procedures and compliance with them.

A.4.3 Quality Assurance During Design and Construction

A.4.3.1 Organization

NES is comprised of a number of operating divisions under an executive vice president, as shown in Figure A.4-1. The authority and responsibility of each activity shown on this chart and subsequent charts is set forth in an approved, written statement of group responsibility. In addition, written position descriptions are prepared for each management and professional position. These descriptions specify the educational and experimental qualifications of the position.

The quality assurance aspects of NES activities are overseen and coordinated by the NES Quality Assurance Committee. This Committee, appointed by the NES Executive Vice-President, is made up of the quality assurance and reliability managers of the NES divisions. The Committee monitors activities throughout NES to provide assurance to NES management that requirements relating to quality assurance are effectively met. The Committee also considers matters of policy to improve and unify the divisions' quality assurance systems.

Overall contract responsibility for supplying the NSSS is assigned to a project manager within PWR Systems Division (PWR-SD). He provides the focal point for communications among the NES divisions, the applicant, and the architect engineer.

The following is a summary of responsibilities involved in furnishing NSSS equipment and services.

PWR-SD, as shown in Figure A.4-2, is the lead NES Division with regard to the project management, design, and procurement of NSSS equipment.

The Project Department of PWR-SD, through a designated Project Manager, has the primary responsibility within NES for supplying the NSSS equipment and services to the applicant.

The Engineering Department of PWR-SD has the responsibility for the overall design of the NSSS. This responsibility includes:

1. Nuclear, thermal, and hydraulic design by Core Engineering
2. Fluid and electrical systems design by Systems Engineering
3. Mechanical equipment design and mechanics and materials support by Plant Apparatus
4. Control and electrical equipment design by Control and Electrical Systems
5. Licensing services by Safety and Licensing
6. Quality Assurance and Reliability.

The Engineering group within the Nuclear Services Department has design responsibility for containment fan coolers and ventilation equipment.

The Purchasing Department provides the PWR-SD interface with suppliers and with other NES divisions.

The responsibility of PWR-SD at the plant site involves construction consulting. This responsibility is within the Nuclear Construction Department.

The PWR-SD Quality Assurance Department consists of five sections: mechanical equipment, pressure vessels, electrical, reliability engineering, and quality planning. The Quality Assurance Department has responsibility for supplier surveillance, quality assurance audits of the design functions, review of design documents, design reviews, quality documentations, and data feedback and analysis.

Functional Relationships

PWR-SD is divided into a number of functional groups having both direct and indirect responsibility for aspects of the design, fabrication, and construction phases of the project. Close association and interchange of information at all levels exists among the functional groups.

Table A.4-1 and Figure A.4-3 show the relationships among these groups. Figure A.4-3 depicts a functional rather than formal organizational structure. For example, contractual requirements originate in projects and are distributed to licensing and reliability, system functional requirement groups, system design groups, and the equipment design and procurement groups. It can be seen that all aspects of the project are considered at each stage in the overall program, with the respective lead functional group coordinating the efforts of the associated functional groups.

Functional Responsibilities

The functional responsibilities of designing and fabricating NSSS equipment are shown in Table A.4-2. The responsibilities are broken down into three categories: design criteria, detail design, and manufacture. For each category, the organization responsible for performing the particular function is identified. Table A.4-2 identifies the scope of the Quality Assurance Program for both safety and non-safety equipment. The identification of safety-related equipment is covered in other chapters of this report.

A.4.3.2 Quality Assurance Program

The PWR-SD policy is to provide nuclear power equipment and services that will provide an electric utility with a safe and reliable plant throughout its design life.

This plan is a description of the PWR-SD Quality Assurance Program. The program is supported by written policies and procedures governing quality-related functions and activities from initiation of design through fabrication and shipment. Identification of the principal quality assurance documents is contained throughout this plan.

This plan demonstrates that the PWR-SD Quality Assurance Program complies with the criteria of Appendix B of 10CFR50. In order to facilitate the presentation, measures established for the Quality Assurance Program are described for each criterion.

The Quality Assurance Program provides that contractors and suppliers of NSSS equipment have quality systems consistent with the requirements of the Quality Assurance Criteria.

A.4.3.3 Design Control

Each of the various groups within PWR-SD involved in NSSS design provide measures to assure effective design control. Below is a description of the design control procedures which provide methods for controlling such activities as: specifying quality standards, selection and review, design changes, design interfaces, and implementation of procedures.

The project manager is responsible for identifying to engineering, purchasing, licensing, and quality assurance groups the technical requirements of a nuclear power plant. This identification process is formal and documented. The distribution of this technical information is the start of the design activity on a nuclear power plant. Changes to distributed information are also originated by the project manager.

Safety and licensing prepares safety analysis reports. Prior to the submittal of NSSS portions of safety analysis reports to the applicant, licensing engineers obtain engineering, projects, and quality assurance review and concurrence of technical content. The review process is formal and documented.

Based upon the identified technical parameters, Core and Systems Engineering groups design the nuclear power plant to meet functional, safety, and regulatory requirements. Mechanical and electrical design engineers participate in the functional design process by identifying equipment limitations and resolving functional requirements with equipment capabilities. The output of the core and systems engineering groups is written functional parameters documents.

Control and electrical system engineers, Plant Apparatus Division mechanical design engineers, and Nuclear Service Department engineers are responsible for designing or specifying the NSSS equipment. Equipment specifications are prepared by the electrical and mechanical design engineers. The term "Equipment Specification" as used in this plan includes drawings when they are used instead of equipment specifications. Detailed quality control requirements are specified in the equipment specification or its references. Examples of these are nondestructive tests, acceptance standards, functional tests, and recording the measured values of key characteristics. In the few cases when equipment specifications or design drawings are not used, the specific quality control requirements, tests, and acceptance standards are identified in the purchase order. The design of equipment also provides for access to components for inservice inspection and maintenance as required to assure continued integrity throughout the life of the plant.

Preliminary equipment specifications are reviewed within Westinghouse by systems engineers, materials and process engineers, licensing engineers, quality assurance, Project, and others as required. These independent reviews verify that equipment specifications meet systems requirements, conform to established engineering standards, are adequate from a metallurgical and welding point of view, meet code requirements, satisfy safety requirements including those specified in safety analysis reports, and contain necessary quality control requirements. Written engineering instructions describe the requirements of the review and require written documentation.

Documented procedures control design changes. These procedures require appropriate groups to review and approve the changes according to written engineering instructions.

Aspects of the equipment design that have an effect on that part of the plant design performed by the applicant or architect engineer are forwarded to them for their review. Applicant or architect engineer drawings which have an effect on the NES scope of supply are likewise sent to NES engineers for their review.

The implementation of the design control system is audited by Quality Assurance Department.

In addition to the verification of technical requirements discussed above, formal design reviews are conducted by Reliability Engineering on critical systems, subsystems, and components to improve their reliability and to reduce fabrication installation, and maintenance costs. The design reviews are comprehensive, systematic studies by personnel representing a variety of disciplines which are not directly associated with the development of the product. Specialists from other Westinghouse divisions and outside consultants are used in the reviews as necessary. Information developed by the reviews is recorded for evaluation and action by the cognizant design engineer. The design review procedure requires the resolution of open items within specified periods. Reliability engineers verify completed action.

The design review program is projected over a substantial period of time because of the comprehensive nature of each review. Both the scheduling of the review and the selection of specific equipment for review are based upon many considerations including whether the equipment is of a new design, its importance to public health and safety, its importance to plant availability and performance, and previous experience with the equipment. In this priority scheme, some equipment of proven design may not receive a formal design review.

Verification calculations and performance testing are accomplished as necessary. A discussion of the means by which seismic requirements are satisfied describes the decision and control process involved. Seismic criteria are provided by the applicant. These criteria are forwarded by the project manager, as previously described, to the Mechanics Technology group within Plant Apparatus. A seismic coordinator distributes the seismic criteria to equipment design engineers for inclusion in equipment specifications. These specifications, which are reviewed by Mechanics Technology personnel, require supplier submittal of either calculations or tests data demonstrating that the equipment is seismically qualified. The design engineer reviews and checks the supplier submittals. Seismic calculations are forwarded to the Mechanics Technology group for final review and certification. The final review process includes an independent recalculation when the seismic adequacy is doubted. The various events within this process, for example, equipment specification review, are performed in accordance with procedures which require documented results.

Interface Control

Operating procedures and instructions detail the interfaces between participating NES organizations. Purchase order requirements clearly define supplier responsibilities with respect to design specifications and approvals. There the interface is particularly complex, separate interface documents are prepared. An example of this situation is the PWR Systems Division-NFD interface document.

A.4.3.4 Procurement Document Control

In general, the procurement of components, systems, structures, and material within PWR-SD falls into two distinct areas:

1. Components procured by PWR from Nuclear Equipment Divisions

2. Components, systems, and structures procured by PWR from non-NES suppliers.

As described in Section A.4.3, equipment specifications and drawings receive a detailed review prior to issue. Purchase orders reference equipment specifications and drawings as the technical basis of procurement. A quality assurance procedure requires quality engineers to review purchase order. The review process assures that the purchase order defines the equipment being procured and clearly specifies technical and quality requirements. When discrepancies are noted, a written request for corrections is initiated.

Quality requirements that apply specifically to a component are contained in the equipment specification. Quality system requirements of a general nature are contained in two standard documents.

The first document is entitled, "Administrative Specification for the Procurement of Nuclear Steam Supply System Components." This document is applied in all component purchase orders. The Administrative Specification requires the supplier not only to manufacture equipment that conforms to purchase order requirements, but to assure himself and Westinghouse by means of appropriate inspections and tests that the equipment conforms to these requirements. The quality control section of this specification contains specific requirements in areas such as:

1. Organization

2. Purchasing control

3. Receiving inspection

4. Material control

5. Control of drawing and procedures

6. Calibration of measuring and test equipment

7. Personnel qualifications

8. Deviations from specifications

9. Special process and test procedures

10. Handling and storage procedures

11. Inspection and manufacturing control

12. Quality records

13. Quality release.

The second document that specifies quality requirements is QCS-1, "Manufacturer's Quality Control Systems Requirements". This document is applied to orders for more critical safety equipment. This document requires the supplier to maintain an adequate quality control systems. This specification meets NA 4000 of Section III of the ASME Boiler and Pressure Vessel Code in the area of quality control system requirements. QCS-1 requires the following, among other things:

1. Establishment and maintenance of a system for the control of quality that assures that all supplies and services meet all specification, drawing, and contract requirements

2. Application of the system to subcontracted items

3. Written procedures that implement the system

4. Qualification of personnel

5. Qualification and control of processes including welding, heat treating, nondestructive testing, quality audits, and inspection techniques.

6. Operation under a controlled manufacturing system such as process sheets, travelers, etc.

7. Written inspection plans for in-process and final inspection

8. Submittal of inspection checklists for approval

9. Recording of results of inspection operations

10. Written work and inspection instructions, for handling, storage, shipping, preservation, and packaging.

As required, inspection hold points are specified in the equipment specification or elsewhere in the purchase order. These are points of witness or inspection by Westinghouse beyond which work may not proceed without approval by PWR-SD.

NSSS equipment ordered by PWR-SD from other NES divisions is specified by equipment specifications or drawings. Quality assurance programs have been developed and implemented by these divisions that meet the intent of 10CFR50, Appendix B.

A.4.3.5 Instructions, Procedures, and Drawings

Within PWR-SD, written procedures and instructions are in use to implement the Quality Assurance Program and provide assurance that all activities affecting quality in the context of 10CFR50, Appendix B, are documented. They are in formats appropriate to their applications, such as:

1. Management responsibility statements
2. Position descriptions of management and professional personnel
3. Engineering instructions
4. Quality assurance and reliability procedures
5. Projects procedures
6. Purchasing procedures
7. Construction site procedures.

Each of the above contains detailed procedures and instructions relating to the functioning of the Quality Assurance Program. Approval and distribution of the procedures is controlled by the manager responsible. For example, engineering procedures within PWR are approved by the Engineering Manager and distribution is controlled by his staff. Other groups affected by one department's procedures review the procedures prior to their approval.

Table A.4-3 identifies, for the various PWR manuals and written procedures, the 10CFR50 criteria which are addressed.

Technical and contractual information necessary to assure effective implementation of these policies, and procedures is developed, documented, and controlled through a standard Westinghouse system which consists in part of the establishment of:

1. System Design Parameters
2. Equipment Specifications
3. Corporate Process Specifications
4. Corporate Material Test Specifications
5. Corporate Purchasing Department Specifications (including specifications for materials)
6. Component Specifications
7. Drawings, Drawing Lists, and Bills of Material
8. Purchase Orders

9. Operating Procedures

10. Quality Assurance Procedures.

The Quality Assurance Program provides that all activities affecting quality will be accomplished in accordance with documented instructions, procedures, drawings, and the appropriate quantitative and qualitative means of verifying quality are satisfactorily accomplished and included as appropriate.

A.4.3.6 Document Control

The PWR-SD provides measures to assure effective document control. The document control procedures provide methods for establishing control of instructions, drawings, and procedures related to quality and safety. In addition, these procedures provide a means to assure that obsolete documents are not used; that controls are exercised for document changes; and that review and approval of changes is performed by organizations who originated the document. Measures are used to control the content and issuance of all design documents affecting quality. These measures assure that standards, new and revised design documents, equipment specifications, and drawings are systematically reviewed and approved by cognizant personnel in engineering, quality assurance, purchasing, and projects prior to release. Distribution of these initial and revised documents is controlled and limited, consistent with approved distribution lists. Specifically for drawings, satellite files throughout the division are on a controlled distribution so that obsolete drawings are returned to the central file when revised drawings are issued. In addition, computer printouts identify the applicable revision to all drawings. If revisions are made to the documents, they are revised according to a documented procedure so that control is maintained.

A.4.3.7 Control of Purchased Material, Equipment, and Services

Prior to considering a new supplier for placement of a purchase order, a supplier evaluation is conducted. This is done in accordance with a written checklist. The results are documented in a report issued to management personnel or purchasing, engineering, quality assurance, and projects. The evaluation is conducted by a team consisting of personnel from the Purchasing, Engineering, and Quality Assurance Departments. Other personnel such as material and process engineers and manufacturing engineers participate, as required.

Considerations of the evaluation include all elements of the 10CFR50 Quality Assurance Criteria to the extent these criteria are applicable to the equipment being procured. Deficiencies in the supplier's organization or systems are resolved with the supplier's management prior to placing a purchase order. If an existing supplier does not maintain the required quality level on PWR-SD orders, a similar team will review the supplier's problems and make recommendations to his management to correct the situation immediately. When problems arise, Westinghouse specialist aids the supplier in specific areas such as welding, manufacturing, and nondestructive testing to resolve the problem. In this manner, Westinghouse assures the continued high level of supplier performance necessary to obtain the quality level required by the contract.

PWR-SD surveillance of suppliers during fabrication, inspection, testing, and shipment of components is planned in advance and performed in accordance with written quality plans. These plans are prepared by quality assurance engineers and are based on the technical requirements of the purchase order. The plans are reviewed and approved by engineering.

The purpose of a quality plan is to provide planned guidance to the quality assurance field representative by:

1. Identifying those characteristics which are most important to quality and reliability

2. Providing specific instructions for the witnessing, documentation, and acceptance of the equipment

3. Detailing audits to assure the supplier's compliance with all quality control requirements.

The plan identifies those supplier documents requiring approval and the points during manufacturing and test that quality assurance intends to witness. Special emphasis is placed on the aspects of manufacture and inspection that most directly affect performance of the equipment. Lead units of a new design get particular attention in the supplier's shop by both Quality Assurance and Engineering Department representatives.

When surveillance is indicated, the Quality Assurance Department develops a visit schedule. Visits are more frequent during the initial stages of manufacture, particularly to a new supplier, with frequency diminishing as the supplier demonstrates his capability. The purpose of PWR-SD surveillance of supplies is to provide Westinghouse management first-hand objective assurance of compliance with specified requirements. The principle followed is that the supplier is responsible for inspecting and testing his product. The PWR-SD field representative assures that the supplier has done this, rather than attempting to perform the supplier's inspection for himself or duplicate the work he has done.

The frequency and scope of surveillance varies with degree of importance of equipment, supplier performance, complexity of the component, and other factors. This determination is made by the Quality Assurance Department in conjunction with the Engineering Department. Quality Assurance residents are established as necessary.

Surveillance is accomplished in accordance with the quality plans described above. In addition, the field representative sees that written instructions and procedures are kept current, that corrective action is implemented, and that other necessary controls are effective. The Quality Assurance representative informs, in writing, the supplier directly of problems he discovers and obtains commitments to correct them. He brings these problems to the attention of the supplier's management as required to obtain resolution. PWR-SD management is made aware of the surveillance activities, including supplier discrepancies and audit results, by means of the trip report issued by the Quality Assurance representative for each visit to a vendor.

When the Quality Assurance representative is satisfied that the equipment can be released for shipment, he prepares a quality release form and distributes copies to the supplier and cognizant personnel within PWR-SD. The equipment can then be released through normal engineering-purchasing channels for shipment. The supplier forwards the quality release with the equipment to the plant site.

In some instances the supplier is authorized by PWR-SD to prepare a supplier quality release. This authorization is given only to those suppliers who have, over a period of time, demonstrated an effective quality system. PWR-SD Quality Assurance personnel periodically audit the supplier's system to assure continued performance.

Westinghouse furnishes for each component at the construction site a copy of the purchase order, including changes, the design specification, and a quality release. These documents certify component quality and satisfy regulatory requirements pertaining to site documentation.

A.4.3.8 Identification and Control of Material, Parts, and Components

Within each of the NES Divisions, procedures exist establishing measures which assure that identification and traceability of items is maintained during the production of components for delivery to the nuclear power plant site.

QCS-1 and the Administrative Specification contain requirements that a supplier have measures to maintain identification and control of material, parts, and components. The procedures used to establish these measures, and the application of the procedures are reviewed for adequacy during supplier selection and monitored for compliance during the surveillance activities.

A.4.3.9 Control of Special Processes

QCS-1 and the Administrative Specification contain requirements that a supplier have measures for control of special processes. These means include the qualification of processes and personnel for welding and inspection in accordance with ASME requirements, nondestructive inspection per SNT-TC-lA standards, and other processes as may be necessary for adequate control. The procedures used to implement these measures and the application of the procedures are reviewed for adequacy and monitored for compliance during the surveillance activities.

PWR-SD personnel are qualified in accordance with a NDT certification program which conform to SNT-TC-lA.

A.4.3.10 Inspection

The principle followed is that the supplier is responsible for inspecting his product, and PWR quality assurance personnel verify his controls to assure the adequacy of inspection. As such, inspection at PWR is more appropriately described as supplier surveillance. Details of the PWR surveillance program are contained in the description of "Control of Purchase Material, Equipment, and Services," Section A.4.3.7.

A.4.3.11 Test Control

QCS-1 details that tests required by a contract be described by clear and current written procedures which assure that tests are performed as specified. The criteria for acceptance or rejection shall be included. The procedures for meeting the above are a part of the supplier quality plant submitted to PWR-SD for approval. The Administrative Specification contains similar requirements. These two documents also require that the supplier maintain records showing the results of tests. These records are reviewed for acceptability by PWR-SD. Tests are conducted by groups within the supplier organization considered acceptable during supplier selection and monitored during PWR-SD surveillance.

A.4.3.12 Control of Measuring and Test Equipment

The requirement for a supplier to maintain a system for calibration of all examination, measuring, and test equipment is contained both in the Administrative Specification and QCS-1. All calibration must be traceable to national standards. PWR verifies the acceptability of the system during the supplier selection and monitors for compliance during the surveillance activities.

A.4.3.13 Handling, Storage, and Shipping

The Administrative Specification and QCS-1 specifies that a supplier's Quality Program require the use of handling procedures and handling equipment inspection procedures to prevent damage to a product. The vendor must have adequate written work and inspection instructions for storage, preservation, packaging, and shipping to protect the products from damage, loss, deterioration, or substitution. As required by the Equipment Specification, these procedures may be subject to approval by PWR.

A supplier's procedures and systems for handling, storage and shipping are evaluated during source selection and monitored for compliance during PWR-SD Quality Assurance Surveillance.

A.4.3.14 Inspection, Test, and Operating Status

QCS-1 and the Administrative Specification contain requirements that a supplier have measures to indicate an inspection, test and operating status of an item. The procedures used to establish these measures and the application of the procedures are reviewed for adequacy during supplier selection and monitored for compliance during the surveillance activities.

A.4.3.15 Nonconforming Material, Parts, or Components

PWR-SD has documented procedures to control nonconforming material, parts, and components which prevent their inadvertent use and provide for their identification, segregation, and disposition. Normally, each NES division dispositions these nonconforming material reports which vary from specifications and standards established within the division. Nonconformances of PWR-SD equipment specification requirements are dispositioned by PWR-SD. All approved nonconformance reports are identified on the final quality release. In addition, nonconformances which affect site installation, test, maintenance, or operation are submitted to the applicant.

Deficiencies at Supplier's Plants

The Administrative Specification and QCS-1, described above, contain specific contractual requirements for controlling nonconforming material or workmanship.

The supplier must physically identify all material that does not conform to the purchase order requirements and take necessary actions to preclude its further use. All deviations are documented in writing and reviewed by the Engineering, Quality Assurance, and other appropriate groups. First, consideration is given to restoring the material to its specified condition or scrapping it. If that is impractical, the deviation is considered from both an engineering and a quality control point of view. If acceptable, the deviation is formally approved in writing by the cognizant engineer. A permanent file of these records is maintained.

Deficiencies at the Construction Site

A written procedure provides for documented reporting by Westinghouse personnel of deficiencies on NSSS equipment found during plant construction. These reports are submitted by Westinghouse site engineering personnel to the cognizant engineering department. Like reports from suppliers' plants, these reports are reviewed for necessary action, formally approved by the cognizant engineer, and permanently filed. Summary reports are developed to alert appropriate levels of management of the deficiencies found and the actions taken.

A.4.3.16 Corrective Action

PWR-SD has a corrective action program which has a means for determining the need for corrective action, documenting the need and the action taken, and reporting the need and action taken to appropriate levels of management. In addition, QCS-1 requires that the supplier's quality system provides for the identification and evaluation of significant or recurring discrepancies and for alerting the supplier's cognizant management of the need for corrective action. The supplier must review corrective action for effectiveness and the need for further action. The suppliers corrective action program is reviewed for adequacy during supplier selection and monitored for compliance during the surveillance activities.

The Quality Assurance Department analyzes through a computerized coding system significant deficiency data on Westinghouse-supplied equipment received from suppliers and from construction sites to determine patterns of occurrence by supplier, by components, or by process. With this as a guide, quality assurance and cognizant engineers determine corrective actions that are needed to prevent recurrence. This action is in addition to assuring that the supplier or site personnel take corrective action of the individual deficiencies reported. Through periodic reports, management is informed of the need for action, and the action taken. Several of the reports are: trip reports, field discrepancies report summaries, and audit reports.

A.4.3.17 Quality Assurance Records

The Quality Assurance Program requires the retention of those fabrication, inspection, and surveillance records essential to demonstrating product quality. Records relating to the design and fabrication of NSSS equipment are available for review.

The Administrative Specification described previously requires suppliers to maintain records for each test (nondestructive, electrical, and performance) specified in the purchase order. The Administrative Specification and equipment specification also require maintenance of other records as required, such as material test reports, welder qualifications, inspection records, etc. Records such as trip reports, deviation notices, and other quality-related documents form a part of the records maintained by PWR-SD.

All suppliers are required to maintain these records for specified periods, after which they notify PWR-SD for disposition. Copies of records covering significant inspections on critical portions of the component are transmitted to PWR-SD. These inspection records along with quality-related documents generated by PWR-SD quality assurance personnel comprise the permanent quality file for each component which will be maintained for the life of the plant. The supplier retains all data relative to the component, and PWR-SD obtains copies of sufficient records to furnish objective evidence of quality, which are maintained as part of the PWR-SD history file. These records will be provided to, or provisions made for maintenance for the owner, in accordance with the contractual agreement with the owner.

Records generated at the construction site are filed and maintained there.

A.4.3.18 Audits

To verify the effectiveness of Quality Assurance Program, PWR has a comprehensive system of audits. Planned and scheduled audits are conducted by:

1. The Corporate Quality Staff of the PWR-SD
2. The NEW Quality Assurance Committee or PWR-SD
3. PWR-SD of other NES divisions for intra-NES purchases
4. PWR-SD of its suppliers
5. PWR-SD of Westinghouse site activities
6. PWR-SD of its own internal programs.

The program requires the originator of an audit report to follow an open item until action is taken to satisfy the audit report. Records of each audit and resolution are maintained.

Below is a description of the various audits within PWR-SD.

A.4.3.18.1 Westinghouse Corporate Audits

The Westinghouse Corporate Headquarters Quality Control Staff has a formal audit program which applies to all divisions in Westinghouse including divisions furnishing equipment or services to the nuclear industry.

The purpose of the audits is to provide an independent verification that the Quality Assurance Programs of the Westinghouse divisions are effectively assuring that the product quality complies with the requirements of their customers and that the programs include the most effective approaches to prevent the manufacture of defective products.

Audits are performed of each division's quality assurance effort by a two man team, consisting of a member of the Headquarters Quality Control staff and the Quality Assurance Manager of another division in the same product group as the division audited. The audit normally takes five days. The Corporate Headquarters audit of each Westinghouse division is held on the average of once each three years.

The quality assurance systems and procedures that have been established by the division are reviewed to determine if these systems and procedures are sufficient to provide an effective program. Observations are then made to assure that the established systems and procedures are being correctly followed.

An oral presentation of the findings and conclusions of the audit is made to the Division General Manager, Quality Assurance Manager, and other personnel affected by the audit findings. The items recommended for improvement in the Quality Assurance Program are presented as well as recommendations of approaches for accomplishing these improvements.

Following the audit, a written report containing the findings and recommendations reviewed in the oral report is prepared and sent to the responsible division personnel. In addition, a copy of the report is sent to the Executive Vice-President to whom the division reports and to the corporate Vice-President of Manufacturing.

A.4.3.18.2 NES Quality Assurance Committee Audits

The Westinghouse NES Quality Assurance Committee has established an audit program which applies to all the NES Westinghouse divisions engaged in nuclear supply system design or manufacture of PWR equipment. The purpose of the audits is to provide in-depth evaluation of the quality assurance policies and processes of the various Westinghouse NES divisions in order to verify that they result in products and services which meet safety and reliability requirements. Particular emphasis during the audit of the quality assurance programs is placed on compliance with nuclear safety requirements.

In addition to carrying out audits, the committee serves as a forum to communicate quality and reliability activities, and to establish improved and consistent division policies of quality assurance in light of nuclear industry requirements.

Annual quality assurance system audits are conducted of each Westinghouse NES Division by an audit team composed of representatives from the Committee. Typical team membership is three men. Each audit normally takes three days. The Corporate Headquarters audits, described above, or Westinghouse NES Division substitutes for the annual Westinghouse NES audit the year it is held.

At the conclusion of each audit, an oral presentation is made by the audit team to the division General Manager and Quality Assurance Manager of the division which has been audited.

Following the audit, a written report, containing the findings of the audit and recommendations for improvement in the Quality Assurance Program and its implementation, is sent to the responsible division personnel, to the committee members, and to the Westinghouse NES Executive Vice-President. The procedure assures high level management attention to actions needed to carry out recommendations of the audit.

A.4.3.18.3 PWR-SD

A.4.3.18.3.1 Supplier's Plants

The Westinghouse PWR-SD audit function of suppliers is described in Section A.4.3.7, Control of Purchased Material, Equipment, and Services. The NES Manufacturing Divisions are also considered as suppliers to PWR, and scheduled audits of the divisions are conducted by PWR Quality Assurance Department.

A.4.3.18.3.2 Construction Site

The Quality Assurance Department conducts independent audits of NSSS work performed by Westinghouse personnel at the construction site to assure that proper procedures and instructions are available and in use, and that adequate controls exist and are effective. Reports of audits are sent to top management of the PWR-SD.

A.4.3.18.3.3 Internal

The Quality Assurance Department performs audits within the PWR-SD. These audits cover procedures and implementation of the procedures. The audits are performed periodically by a team headed by quality assurance personnel and selected from appropriate engineering groups or PWR-SD and from outside divisions as necessary. Audit findings are documented and sent to management for review and corrective action, where necessary.

Additional audits of PWR-SD are conducted by the NES Quality Assurance Committee and the Westinghouse Headquarters Quality Control Staff.

A.5 WESTINGHOUSE NUCLEAR FUEL DIVISION RELIABILITY AND QUALITY ASSURANCE PROGRAM

Section A.5 describes the Westinghouse Nuclear Fuel Division Reliability and Quality Assurance Program applicable during the initial fuel of BVPS-1. For convenience, this section is retained in the Updated FSAR as a history of the program in effect during the initial fueling.

A.5.1 Quality Assurance Program

The Reliability and Quality Assurance Program of the Westinghouse Nuclear Fuel Division, as summarized in WCAP-7800, has been developed to serve the division in planning and monitoring its activities for the design and manufacture of nuclear fuel assemblies and in the manufacture of the associated core components.

The program provides for control over all activities affecting product quality, commencing with design and development and continuing through procurement, materials handling, fabrication, testing and inspection, storage, and transportation. The program also provides for the indoctrination and training of personnel and for the auditing of activities affecting product quality through a formal auditing program.

A.5.2 Manufacturing

Quality Control philosophy is generally based on the following inspections being performed to a 95 percent (95 x 95) confidence that at least 95 percent of the product meets specification, unless otherwise noted, using either a hypergeometric function with zero defectives for small lots or the latest revision of MIL-105D for large lots. This confidence level has been based on past experience gained during the manufacturing of uranium cores. The following inspections are included.

Components Parts

All parts received are inspected to a 95 x 95 confidence level. The characteristics inspected depend upon the component parts and includes dimensional, visual, check audits of test reports, material certification and nondestructive testing such as X-ray and ultrasonic. Westinghouse materials process and components specifications specify in detail the inspection, to be performed.

All material used in the manufacture of this core is accepted and released by Quality Control.

Pellets

Inspection is performed to a 95 x 95 confidence level for the dimensional characteristics such as diameter, density, length and squareness of ends. Additional visual inspections are performed for cracks, chips and porosity according to standards established at the beginning of production. These standards are based upon standards used in previous cores which have in turn served as standards for over 50 million pellets manufactured and used in operating cores. Density is determined in terms of weight per unit length and is plotted on zone charts used in controlling the process. Chemical analyses are taken on a daily sample basis throughout pellet production.

Rod Inspection

Fuel rod inspection techniques used by Westinghouse during the plant operations phase are described in Section 3.2 of this FSAR.

Preoperational Rod Inspection consisted of the following 100 percent nondestructive inspections and is based on the experience specifications, procedures and standards established on previously manufactured and operated cores.

1. Leak Testing - Each rod is tested to a known leak using mass spectrometry with helium being the detectable gas. This is the system used previously on the leak test of over 300,000 rods.

2. X-ray - All fuel rod weld enclosures are X-rayed using weld correction forms. X-rays are taken in accord with ASTM E-142-68, "Controlling Quality of Radiographic Testing", using 2-2T as the basis of acceptance.

3. Dimensional - All rods are dimensionally inspected prior to final release and upgrading. The requirements include such items as length, caber, and visual inspection.

4. Fluoroscope - 100 percent of the fuel rods are tested to ensure proper plenum dimensions and ensure that no significant gaps exist between pellets.

This ensures that 100 percent of the rod welds have been checked by several different techniques. Full traceability of fuel rods and fuel rod components is also established by Quality Control.

Assembly

Inspection consists of 100 percent inspection for drawing requirements.

Other Inspections

The following inspections are performed as part of the routine inspection operation:

1. Measurements other than those specified above which are critical to thermal and hydraulic analysis were obtained to enable evaluation of manufacturing variations to a 95 x 95 confidence level.

2. Tool and gauge inspection and control, including standardization to primary and secondary working standards. Tool inspection is performed at prescribed intervals on all serialized tools. Complete records are kept of calibration and condition of tools.

3. Check audit inspection of all inspection activities and records to ensure that prescribed methods are followed and that all records are correct and properly maintained.

Process Control

To prevent the possibility of mixing enrichments during fuel manufacture and assembly, strict enrichment segregation and meticulous process control are exercised.

The UO_2 powder is kept in sealed containers by blend. The contents are fully identified both by descriptive tagging and preselected color coding. A Westinghouse identification tag completely describing the contents is affixed to the containers before transfer to powder storage. Isotopic content is confirmed by sample isotopic analysis or 100 percent gamma scanning of powder containers.

Powder withdrawal from storage can be made by only one authorized group which directs the powder to the correct pellet production line. All pellet production lines are physically separated from each other and pellets of only a single enrichment and density are produced in a given production line.

Finished pellets are placed on trays having the same color code as the powder containers and transferred to segregated storage racks within the confines of the pelleting area. Samples from each pellet lot are tested for isotopic content and impurity prior to acceptance by Quality Control. In this storage area physical barriers prevent mixing of pellets of different densities and enrichments. Unused powder and substandard pellets to be analyzed and reprocessed are returned to storage in the original color coded containers. Loading of pellets into the cladding is performed in isolated production lines and again only one density and enrichment is loaded on a line at a time.

A serialized traceability sticker is placed on each fuel tube which identifies the contract and enrichment. The sticker is color coded to the original pellet tray code for visual identification. The end plugs are inserted and the bottom end plug is permanently identified to the contract and enrichment and welded to seal the tube. The fuel tube remains color coded and traceability identified until just prior to installation in the fuel assembly. The color coding and end plug identification character and traceability stickers provide a cross reference of the fuel contained in the fuel rods. All fuel rods are gamma scanned over the full length for isotopic content prior to acceptance for assembly loading.

At the time of installation into an assembly, the color coding and traceability stickers are removed and a matrix is generated to identify each rod in its position within a given assembly.

An inspector verifies that all fuel rods in an assembly have the same end plug identification, and that the top nozzle to be used on the assembly carries the correct identification character describing the fuel enrichment and density for the core region being fabricated. The top nozzle identification then becomes the permanent description to the fuel contained in the assembly.

A.5.3 Operating Experience

The quality assurance program with respect to fuel design and fabrication minimizes or reduces potential rod failures due to clad hydriding, clad-flattening and UO_2 clad interactions.

Evaluation of fuel leakage in Region 3 of the Besnau Unit No. 1 and Ginna cores had led to the conclusion that it was caused primarily by excess moisture in those rods. This caused local hydriding and subsequent breaching of the Zircaloy clad. Test programs initiated prior to and concurrent with the initial development of leaks at Besnau and Ginna led to the implementation of design and fabrication changes long before the postulated cause of the leaks was confirmed by the site examinations. These changes were directed toward reducing and controlling the fuel-contained moisture levels. Operating experience since that time prove that they were successful.

Clad-flattening has been observed in non-pressurized fuel rods during refueling shutdowns at several reactors. BVPS-1 fuel included fuel rod pre-pressurized and fuel fabricated to a density of 95 percent theoretical using improved manufacturing processes. The Westinghouse fuel design sequence includes a clad-flattening evaluation to ensure that clad-flattening is precluded during fuel core life and that the potential for UO_2 clad interactions is minimized. Detailed clad stress analyses are strongly affected by the control rod management which is selected during the final nuclear design and the specific fuel rod design. The fuel design including use of pre-pressurized rods, in combination with plant operation and protection systems, will minimize clad failures due to potential UO_2 clad interactions during power transients.

The quality control discussion of the fuel manufacturing notes how statistical quality control is used.

TABLES FOR APPENDIX A

Table A.1-1

CATEGORY I STRUCTURES, SYSTEMS, AND COMPONENTS

Structures

Containment structure

- Reinforced Concrete Substructure
- Reinforced Concrete Superstructure
- Reinforced Concrete Interior Shields and Walls
- Steel Plate Liner
- Piping, Duct and Electrical Penetrations and Shield Wall
- Personnel Access Hatch
- Equipment Access Hatch

Cable Vault and Cable Tunnel

Pipe Tunnel to Containment from Auxiliary Building

Main Steam Valve Area

Pump Room Below Main Steam Valve Area

Safeguards Area

Safeguards and Main Steam Valve Area Ventilation Rooms

Primary Auxiliary Building

- Reinforced Concrete Structure
- Steel Superstructure

Fuel Building

- Reinforced Concrete Structure
- Steel Superstructure
- Spent Fuel Storage Rack
- Fuel Handling Trolley Support Structure

Duct Lines and Manholes to Intake Structure and Diesel Generator Building

Control Room

Emergency Switchgear and Relay Room

Battery Rooms

Cable Tray Area in Service Building

Table A.1-1 (CONT'D)

CATEGORY I STRUCTURES, SYSTEMS, AND COMPONENTS

Air Conditioning Equipment Room for Control Room

Diesel Generator Building

River Water Pumps and Engine-Driven Fire Pump Intake Structures

Waste Gas Storage Area

Systems and Components

Containment Isolation Valves - Containment Isolation

Valves and Associated Piping

Reactor Coolant System

Steam Generators
Steam Generator Supports
Reactor Coolant Pumps
Reactor Coolant Pump Supports
Pressurizer and Pressurizer Heaters

Pressurizer Support

Reactor Vessel

Reactor Core Support Structure
Reactor Control Rod Guide Structure
Fuel Assemblies
Control Rod and Drive Shaft Assemblies
Incore Instrumentation Thimbles

Reactor Vessel Supports and Neutron Shield Tank

Control Rod Drive Mechanisms

Reactor Coolant Piping, Valves and Supports

Reactor Coolant Bypass Piping, Valves and Supports

Pressurizer Surge Line

Pressurizer Spray Lines, Valves and Supports

Pressurizer Safety and Relief Valves Piping

Table A.1-1 (CONT'D)

CATEGORY I STRUCTURES, SYSTEMS, AND COMPONENTS

Safety Injection System

- Accumulators and Supports
- Boron Injection Tank
- Low Head Safety Injection Pumps and Piping
- Piping, Valves and Supports*

Quench Spray Subsystem

- Refueling Water Storage Tank
- Quench Spray Pumps
- Piping, Valves and Supports*

Recirculation Spray Subsystems

- Recirculation Spray Pumps and Piping
- Recirculation Spray Heat Exchangers
- Reactor Containment Sump and Screens
- Piping, Valves and Supports*

Containment Vacuum and Leakage Monitoring System

- Open Pressure Taps up to and Including Second Automatic Containment Isolation Valve

Chemical and Volume Control System

- Boric Acid Tanks
- Boric Acid Transfer Pumps

- Boric Acid Blender
- Charging/Safety Injection Pumps
- Regenerative Heat Exchanger
- Nonregenerative Heat Exchanger

* The Asset Equipment List (AEL) can be used to determine the QA Category for specific piping, valves and supports

Table A.1-1 (CONT'D)

CATEGORY I STRUCTURES, SYSTEMS, AND COMPONENTS

Chemical and Volume Control System (Continued)

- Reactor Coolant Filter
- Volume Control Tank
- Seal Water Heat Exchanger
- Seal Water Filter
- Seal Water Injection Filters
- Excess Letdown Heat Exchanger
- Piping, Valves and Supports*

Residual Heat Removal System

- Residual Heat Removal Pumps
- Residual Heat Exchangers
- Piping, Valves and Supports*

Component Cooling System

- Primary Plant Component Cooling Water Heat Exchangers
- Primary Plant Component Cooling Water Pumps
- Component Cooling Surge Tank
- * Piping, Valves and Supports Associated with Above Components and the Following:

  Lines to and from Residual Heat Exchangers and Residual Heat Removal Pump Seal Coolers

  Lines to and from Fuel Pool Heat Exchangers 8 in., 18 in. and 24 in. Headers and In Lines to and from Components not listed above up to and including Second Automatic Isolation Valves

* The AEL can be used to determine the QA Category for specific piping, valves and supports

Table A.1-1 (CONT'D)

CATEGORY I STRUCTURES, SYSTEMS, AND COMPONENTS

Fuel Pool Cooling and Purification System

- Fuel Pool Pumps
- Fuel Pool Heat Exchangers
- Piping, Valves and Supports*

River Water System

- River Water Pumps
- River Water Piping, Valves and Supports to Category I Components*

Sample System

- Primary Coolant and Blowdown Sample Lines to and Including Containment Isolation Valve Outside Containment

Fuel Handling System

- Fuel Transfer Tube with Blind Flange

Auxiliary Steam and Air Removal System

- Containment Isolation Valves and Piping in Between

Vent and Drain System

- Containment Isolation Valves and Piping in Between

Steam Generator Blowdown System

- Piping, Valves and Supports from Steam Generators to Containment Isolation Valves Outside Containment

Ventilation and Air Conditioning

- Supplementary Leak Collection and Release System
- Containment Isolation Valves and Duct Work Within Containment Purge Exhaust and Supply Systems
- River Water Pump Area Ventilation System
- Diesel Generator Building Ventilation System
- Air Conditioning System for Control Room Area Ventilation Vent Stack

* The AEL can be used to determine the QA Category for specific piping, valves and supports

Table A.1-1 (CONT'D)

CATEGORY I STRUCTURES, SYSTEMS, AND COMPONENTS

Main Steam System

- Steam Piping From Main Steam Lines to Turbine Driven Steam-Generator Auxiliary Feed Pumps
- Main Steam Piping from Steam Generators to and including Main Steam Nonreturn Valves, including Trip Valves

Feedwater System

- Main Feedwater Isolation Valves
- Primary Plant Demineralized Water Storage Tank
- Steam Generator Auxiliary Feedpumps
- Main Feedwater Regulating Valves and Bypass Flow Control Valves (This applies only to those parts of the valves which accomplish the prompt closure function from a feedwater isolation signal)
- Following Piping, Valves and Supports:
  - From Primary Plant Demineralized Water Storage Tank to Steam Generator Auxiliary Feedpumps
  - From Steam Generator Auxiliary Feedpumps to Steam Generator Feed Lines
  - Steam Generator Feed Lines Inside Containment to and including First Containment Isolation Valve Outside Containment

Process Radiation Monitoring System

- Recirculation Spray Cooler Service Water Monitor

Area Radiation Monitoring System

- Main Control Room Monitor

Table A.1-1 (CONT'D)

CATEGORY I STRUCTURES, SYSTEMS, AND COMPONENTS

Instrumentation and Control

All Instrumentation and Control Required during a Design Accident or a Controlled Shutdown
Reactor Protection
Safety Injection
Containment Isolation Phases A and B
Feedwater Isolation
Steam Line Isolation
Steam Generator Water Level System

Electrical System

Emergency Diesel Generators
Fuel Oil Day Tanks
Fuel Oil Transfer Pumps
Underground Fuel Oil Storage Tanks
Fuel Oil Piping, Valves and Supports to Emergency Diesel Generators, Except Fill Lines for Underground Fuel Oil Storage Tanks
Emergency Diesel Generator Cooling System
Station Service Batteries and Chargers for Category I Components
Vital Bus and Inverters
480V Emergency Unit Substation for Category I Components
4 KV Emergency Station Service Switchgear for Category I Components
Control Panel Boards for Category I Components
DC Switchboards for Category I Components
Emergency Motor Control Centers
Motors for Engineered Safeguards Components and Safety-Related Equipment
Shutdown Control Panel
Main Control Panel
Cable to Components, Instruments and Controls Required During a Design Accident or a Controlled Shutdown

Miscellaneous

Reactor Containment Crane
Packaging of Radioactive Material for Transportation as per 10 CFR 71

Table A.3-1

STONE & WEBSTER CROSS REFERENCE MATRIX OF IMPLEMENTING DOCUMENTS
(DATED: DECEMBER 6, 1974)

10CFR50 Appendix B Quality Assurance Criteria Implementation References	S&W Quality Assurance Program Manual	Field Quality Control Manual	S&W Quality Assurance NDT Manual	S&W Procurement Quality Control Manual	S&W EA Manual
SECTION I ORGANIZATION	1	1	1,2		1
SECTION II QUALITY ASSURANCE PROGRAM	2	3,13.1	1,4,5	1	1,2,3,4,5
SECTION III DESIGN CONTROL	3.6	N/A	N/A	15	3,4,5
SECTION IV PROCUREMENT DOCUMENT CONTROL	4	4.1,11.1	7	7,8,15,16,19	3,4
SECTION V INSTRUCTIONS, PROCEDURES, & DRAWINGS	5,6	4	4	6 thru 26*	3,4,5,9
SECTION VI DOCUMENT CONTROL	3,4,6,19	1.1	4	8,15 thru 19*	3,4,5,6,9
SECTION VII CONTROL OF PURCHASED MATERIAL, EQUIPMENT & SERVICES	7,8,14	4.2,11.1	6	6,7,8,10,15 thru 19*	3,4,5
SECTION VIII IDENTIFICATION AND CONTROL OF MATERIALS, PARTS & COMPONENTS	7,8,12,14	6.3,8.3	10	7,8,11,17	
SECTION IX CONTROL OF SPECIAL PROCESSES	9	5.6,8.1,6.2, 8.4,8.5	6 thru 18	7,8,10,16	1,3,6,9

Table A.3-1 (CONT'D)

10CFR50 Appendix B Quality Assurance Criteria Implementation References	S&W Quality Assurance Program Manual	Field Quality Control Manual	S&W Quality Assurance NDT Manual	S&W Procurement Quality Control Manual	S&W EA Manual
SECTION X INSPECTION	7,10	5.1,5.3,5.4,5.5, 6.1,6.2,6.4,6.5 7.1,7.2,10.5	6,10 thru 18	11 thru 20*	4
SECTION XI TEST CONTROL	11	10.1,10.2,10.3, 10.4,10.5	5,10 thru 18	16,19,20	1,4
SECTION XII CONTROL OF MEASURING AND TEST EQUIPMENT	12	9.1	6,10	7,8,19	4,12
SECTION XIII HANDLING, STORAGE AND SHIPPING	13	4.3,4.4	N/A	21,22,23	4
SECTION XIV INSPECTION, TEST & OPERATING STATUS	14	10.1	10	10,16 thru 20*	N/A
SECTION XV NONCONFORMING MATERIALS, PARTS OR COMPONENTS	7,14,15,16	3.1,3.2,3.3	N/A		3,15,16
SECTION XVI CORRECTIVE ACTION	15,16	3.1,3.2	N/A		15,16,18
SECTION XVII QUALITY ASSURANCE RECORDS	17	1.3,1.2	5,11 thru 18	7,8,17,20	5
SECTION XVIII AUDITS	18	12.1	1	8,16	18

x - Manual Section Number Direct Correlation

Table A.3-2

QUALIFICATION AND EXPERIENCE REQUIREMENTS
STONE & WEBSTER QUALITY ASSURANCE PERSONNEL

Title	Education*	Background Experience
Vice-President, Quality Assurance	BS/BA	Minimum of 10 years in responsible assignments in heavy construction management, engineering, or quality assurance. At least two years of this time should be in the nuclear field with emphasis on project/division management.
Manager, Quality Assurance	BS/BA	Minimum of 10 years in responsible assignments in engineering and design, quality assurance and control, power station construction, and/or opera- tion.
Chief Engineer, Engineering Assurance	BS/BA	Minimum of five years in responsible assignments in engineering, quality assurance and control, inspection, and/or auditing.
Chief Engineer, Quality Systems	BS/BA	Minimum of five years in responsible assignments in quality assurance and control, and/or construction of a power station.
Manager, Procurement Quality Control	BS/BA	Minimum of five years in responsible assignments in quality assurance and control, and/or shop inspection.

Table A.3-2 (CONT'D)

Title	Education*	Background Experience
Manager, Field Quality Control	BS/BA	Minimum of five years in responsible assignments in quality assurance and control, and/or construction of a power station.
Chief Engineer, NDT Division	BS/BA	Minimum of five years in responsible assignments in nondestructive testing of materials and/or metallurgy.
Project Quality Assurance Coordinator	BS/BA	Minimum of five years in quality assurance and related fields including manufacturing, construction, and/or installation activities. At least two years should be associated with the nuclear field.
Assistant Manager, FQCD, Sr. Supt. of Field Quality Control and Supt. of FQC	BS or High School or	A degree plus five years of experience in quality assurance and related fields, including testing or inspection (or both) of manufacturing, construction, and installation activities. At least two years should be associated with a nuclear facility. High school graduate plus 10 years of experience in general quality assurance or equivalent engineering, manufacturing, construction, and installation activities. Five years of total experience is required in quality assurance, including testing or inspection (or both) of equivalent manufacturing, construction and installation activities. At least two years should be associated with a nuclear facility.

Table A.3-2 (CONT'D)

Title	Education*	Background Experience
Assistant Sr. FQC Engineer	BS or High School	A degree and four years of experience in quality assurance, including testing and/or inspection of equivalent manufacturing, construction and installation activities. At least two years of this experience should be associated with a nuclear facility.
Assistant Sr. FQC Engineer (Continued)	or	High school graduate and eight years of experience in general quality assurance or equivalent engineering, manufacturing, construction, and installation activities. Five years of this experience is required in quality assurance, including testing and/or inspection of equivalent manufacturing, construction and installation activities. At least two years of this experience should be associated with a nuclear facility.
Quality Control Engineer	BS or High School	A degree and 0-2 years of experience in quality assurance including testing and/or inspection of equivalent construction and installation activities.
	or	High school graduate and 5 years of experience in testing and/or inspection of power and/or nuclear plants, heavy industrial, or other similar equipment or facilities.

Table A.3-2 (CONT'D)

Title	Education*	Background Experience
Assistant Quality Control Engineer	BS or High School or	A degree. No experience is required. High school graduate and four years of experience in testing and/or inspection of power and/or nuclear stations, heavy industrial, or other similar equipment or facilities.
Sr. Quality Control Inspector	High School	High school graduate and two years of experience in quality assurance, including testing and/or inspection of equipment, construction and installation activities.
Quality Control Inspector	High School	High school graduate and one year of experience in quality assurance, including testing and/or inspection of equipment, construction, and installation activities.
Quality Control Technician	High School	High school graduate, preferably with some knowledge of quality assurance concepts such as testing or inspection.
Assistant Quality Control Technician	High School	High school graduate; no experience is required.

* Equivalent qualification may be substituted based on other education accomplishments, experience in related fields and technical achievements, such as holding license as a Professional Engineer or Certificate as a Quality or Reliability Engineer by the American Society for Quality Control.

Table A.4-1

WESTINGHOUSE PRESSURIZED WATER REACTOR DIVISION

QUALITY ASSURANCE INTERFACE RELATIONSHIPS (FOR PRESSURIZED WATER REACTOR SYSTEMS DIVISION SCOPE)

ITEM	FUNCTION	ORIGINATING GROUPS	PARTICIPATING GROUPS	SUBSEQUENT ACTION
1.	Dissemination of contractual requirements	Projects		Licensing, quality assurance systems functional require-ment groups, system design groups, equipment design groups
2.	Identificatiaon of safety requirements	Safety and Licensing	Projects, systems function requirement groups	Systems design groups, equipment design groups, applicant
3.	Specification of system functional requirements	Systems functional requirement groups	Projects	System design groups, applicant
4.	System design and equipment functional requirements	System design group	Projects, systems functional requirement groups, safety and licensing applicant	Equipment design groups, architect engineer, site service group, applicant constructor
5.	Equipment specification for drawings	Equipment design groups	System design groups, materials engineering, quality assurance, projects, safety and licensing	Applicant, architect engineer, quality assurance, site service group, constructor
6.	System layout drawings	Architect engineer	System design groups, equipment design groups, applicant	Applicant, constructor
7.	Design reviews (formal reviews selected for critical areas)	Quality assurance	Systems design groups, systems functional require-ment groups, equipment design groups, safety and licensing, projects	Equipment design groups, systems functional requirement groups, systems design groups

Table A.4-1 (CONT'D)

WESTINGHOUSE PRESSURIZED WATER REACTOR DIVISION
QUALITY ASSURANCE INTERFACE RELATIONSHIPS (FOR PRESSURIZED WATER REACTOR SYSTEMS DIVISION SCOPE)

ITEM	FUNCTION	ORIGINATING GROUPS	PARTICIPATING GROUPS	SUBSEQUENT ACTION
8.	Pressurized Water Reactor Systems Division Quality Assurance plan (program description)	Quality assurance	Systems design groups, systems functional require-ment groups, equipment design groups, safety and licensing, projects	Quality assurance applicant, safety and licensing
9.	Quality assurance and reliability manual	Quality assurance	Equipment design groups, purchasing	Quality assurance applicant
10.	Pre-award surveys	Purchasing, quality assurance, equipment design groups	Materials, engineering, projects	Supplier
11.	Supplier design documents	Supplier	Equipment design groups, materials engineering	Supplier, quality assurance
12.	Supplier manufacturing, (for equipment)	Quality assurance	Equipment design groups	Quality assurance
13.	Supplier manufacturing, control and inspection documents	Supplier	Materials engineering, equipment design groups, quality assurance	Quality assurance
14.	Product surveillance and supplier process audits	Quality assurance	Applicant, purchasing	Engineering design groups, materials engineering, projects, supplier
15.	Equipment outline and general assembly drawings, certified for construction	Supplier	Materials engineering, equipment design groups, quality assurance, applicant	Supplier, quality assurance, applicant, constructor, site services group, architect engineer
16.	Equipment instruction manuals	Supplier	Equipment design groups	Applicant, constructor, architect engineer
17.	Quality release	Supplier, quality assurance	Equipment design groups, purchasing, projects	Applicant, constructor, site services group

Table A.4-1 (CONT'D)

WESTINGHOUSE PRESSURIZED WATER REACTOR DIVISION
QUALITY ASSURANCE INTERFACE RELATIONSHIPS (FOR PRESSURIZED WATER REACTOR SYSTEMS DIVISION SCOPE)

ITEM	FUNCTION	ORIGINATING GROUPS	PARTICIPATING GROUPS	SUBSEQUENT ACTION
18.	Receipt inspection at site	Constructor	Applicant, site service group	Projects, applicant, quality assurance, purchasing, equipment design groups
19.	Field inspection, erection and test procedures	Constructor	Equipment design groups, materials engineering, site service group, architect engineer, applicant	Site service group, constructor
20.	Erection	Constructor	Applicant, site service group	Constructor
21.	Startup test requirements	Systems design groups	Safety and licensing, systems functional requirement groups	Applicant, site service group
22.	System test	Constructor	Applicant, site service group	Safety and licensing, system functional requirement groups system design groups, applicant
23.	Technical specifications	Safety and licensing, system design groups	Systems design groups, systems functional requirement groups, materials engineering, applicant, architect engineer	Applicant
24.	Plant operating information	Applicant	Site service group	All Westinghouse groups
25.	Quality assurance audit of site	Quality assurance	Materials engineering, projects	Site service group

Table A.4-2

WESTINGHOUSE NUCLEAR STEAM SUPPLY SYSTEM (NSSS) FUNCTIONAL RESPONSIBILITIES

Component	Design Resp.	Criteria QA	Detail Resp.	Design QA	Resp.	Manufacture QC	QA
REACTOR COOLANT SYSTEM							
Reactor vessel	PWR	A&PWR	S	PWR	S	S	PWR
Reactor vessel support shores and shims	PWR	A&PWR	PWR	PWR	S	S	PWR
Reactor vessel insulation	PWR	A&PWR	S	PWR	S	S	PWR
Full length control rod drive mechanism housing	PWR	A&PWR	EMD	PWR	EMD	EMD	PWR
Part length control rod drive mechanism housing	PWR	A&PWR	S	PWR	S	S	PWR
Reactor coolant pump casing	PWR	A&PWR	EMD	PWR	S	S	EMD
Reactor coolant pump internals	PWR	A&PWR	EMD	PWR	EMD	E	PWR
Reactor coolant pump motor	PWR	A&PWR	EMD	PWR	S	S	EMD
Reactor coolant loop isolation valves	PWR	A&PWR	EMD	PWR	EMD	EMD	PWR
Steam generator (tube side)	PWR	A&PWR	TD	PWR	TD	TD	PWR
Steam generator (shell side)	PWR	A&PWR	TD	PWR	TD	TD	PWR
Pressurizer	PWR	A&PWR	TD	PWR	TD	TD	PWR
Reactor coolant piping	PWR	A&PWR	PWR	A&PWR	S	S	PWR
Reactor vessel internals	PWR	A&PWR	PWR	PWR	PD	PD	PWR
Primary and secondary sources	PWR	A&PWR	S	PWR	S	S	PWR
CRDM durry baffle cans	PWR	A&PWR	PWR	PWR	S	S	PWR
CRDM cooling shroud assembly	PWR	A&PWR	PWR	PWR	S	S	PWR
Bypass manifold	PWR	A&PWR	PWR	PWR	S	S	PWR

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Table A.4-2 (CONT'D)

WESTINGHOUSE NUCLEAR STEAM SUPPLY SYSTEM (NSSS) FUNCTIONAL RESPONSIBILITIES

Component	Design Criteria Resp.	QA	Detail Resp.	Design QA	Resp.	Manufacture QC	QA
Safety valves	PWR	A&PWR	S	PWR	S	S	PWR
Relief valves	PWR	A&PWR	S	PWR	S	S	PWR
Valves to reactor coolant system boundary	PWR	A&PWR	S	PWR	S	S	PWR
Piping to reactor coolant system boundary	PWR	A&PWR	AE	A&PWR	C	C	A
Reactor coolant pump seal bypass orifice	PWR	A&PWR	PWR	PWR	S	S	PWR
Pressurizer relief tank	PWR	A&PWR	PWR	PWR	S	S	PWR
Seal table assembly	PWR	A&PWR	PWR	PWR	PD	PD	PWR
Instrumentation tubing and fittings	PWR	A&PWR	PWR	PWR	S	S	PWR
Control rod clusters	PWR	A&PWR	NFD	PWR	NFD	NFD	PWR
RCC thimble plug	PWR	A&PWR	PWR	PWR	S	S	PWR
Control rod drive mechanism head adapter plugs	PWR	A&PWR	PWR	PWR	S	S	PWR
CHEMICAL AND VOLUME CONTROL SYSTEM							
Regenerative heat exchanger	PWR	A&PWR	S	PWR	S	S	PWR
Letdown heat exchanger	PWR	A&PWR	S	PWR	S	S	PWR
Mixed bed demineralizer	PWR	A&PWR	PWR	PWR	S	S	PWR
Cation bed demineralizer	PWR	A&PWR	PWR	PWR	S	S	PWR
Reactor coolant filter	PWR	A&PWR	S	PWR	S	S	PWR
Volume control tank	PWR	A&PWR	PWR	PWR	S	S	PWR
Centrifugal charging pump	PWR	A&PWR	S	PWR	S	S	PWR
Seal water injection filter	PWR	A&PWR	S	PWR	S	S	PWR
Letdown orifice	PWR	A&PWR	PWR	PWR	S	S	PWR
Excess letdown heat exchanger	PWR	A&PWR	S	PWR	S	S	PWR
Seal water return filter	PWR	A&PWR	S	PWR	S	S	PWR
Seal water heat exchanger	PWR	A&PWR	S	PWR	S	S	PWR
Boric acid tanks	PWR	A&PWR	PWR	PWR	S	S	PWR

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Table A.4-2 (CONT'D)

WESTINGHOUSE NUCLEAR STEAM SUPPLY SYSTEM (NSSS) FUNCTIONAL RESPONSIBILITIES

Component	Design Criteria Resp.	QA	Detail Design Resp.	QA	Manufacture Resp.	QC	QA
Boric acid filter	PWR	A&PWR	S	PWR	S	S	PWR
Boric acid transfer pump	PWR	A&PWR	S	PWR	S	S	PWR
Boric acid blender	PWR	A&PWR	PWR	PWR	S	S	PWR
Resin fill tank	PWR	A&PWR	PWR	PWR	S	S	PWR
Boric acid batching tank	PWR	A&PWR	PWR	PWR	S	S	PWR
Chemical mixing tank	PWR	A&PWR	PWR	PWR	S	S	PWR
SAFETY INJECTION SYSTEM							
Accumulator	PWR	A&PWR	PWR	PWR	S	S	PWR
Safety injection pump	PWR	A&PWR	S	PWR	S	S	PWR
Boron injection pump	PWR	A&PWR	PWR	PWR	S	S	PWR
Boron injection tank recirculation pump	PWR	A&PWR	PWR	PWR	S	S	PWR
Boron injection tank surge tank	PWR	A&PWR	PWR	PWR	S	S	PWR
System valves	PWR	A&PWR	S	PWR	S	S	PWR
RESIDUAL HEAT REMOVAL SYSTEM							
Residual heat removal pump	PWR	A&PWR	S	PWR	S	S	PWR
Residual heat exchanger	PWR	A&PWR	PWR	PWR	S	S	PWR
System valves	PWR	A&PWR	S	PWR	S	S	PWR
REFUELING EQUIPMENT							
RCC changing fixture	PWR	A&PWR	PWR	PWR	S	S	PWR
Control rod drive shaft handling fixture	PWR	A&PWR	PWR	PWR	S	S	PWR

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Table A.4-2 (CONT'D)

WESTINGHOUSE NUCLEAR STEAM SUPPLY SYSTEM (NSSS) FUNCTIONAL RESPONSIBILITIES

Component	Design Criteria Resp.	QA	Detail Design Resp.	QA	Manufacture Resp.	QC	QA
Control rod drive shaft storage racks	PWR	A&PWR	PWR	PWR	S	S	PWR
Guide tube cover handling tool	PWR	A&PWR	PWR	PWR	S	S	PWR
Vessel head lifting device	PWR	A&PWR	PWR	PWR	S	S	PWR
Reactor vessel internals handling device	PWR	A&PWR	PWR	PWR	S	S	PWR
Reactor cavity manipulator crane	PWR	A&PWR	S	PWR	S	S	PWR
RCC thimble plug handling tool	PWR	A&PWR	PWR	PWR	S	S	PWR
Spent fuel assembly handling tool	PWR	A&PWR	PWR	PWR	S	S	PWR
FUEL TRANSFER SYSTEM							
Fuel transfer tube and flange	PWR	A&PWR	S	PWR	S	S	PWR
Fuel transfer components	PWR	A&PWR	S	PWR	S	S	PWR
NUCLEAR INSTRUMENT POWER RANGE							
Detectors	PWR	A&PWR	S	PWR	S	S	PWR
Rack mounted equipment	PWR	A&PWR	S	PWR	S	S	PWR
Balance of System	PWR	A&PWR	S	PWR	S	S	PWR
ROD CONTROL SYSTEMS/ROD POSITION INDICATION SYSTEMS	PWR	A&PWR	S	PWR	S	S	PWR
RADIATION MONITORING	PWR	A&PWR	PWR	PWR	S	S	PWR

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Table A.4-2 (CONT'D)

WESTINGHOUSE NUCLEAR STEAM SUPPLY SYSTEM (NSSS) FUNCTIONAL RESPONSIBILITIES

Component	Design Criteria Resp.	QA	Detail Resp.	Design QA	Manufacture Resp.	QC	QA
SOLID STATE PROTECTION SYSTEM							
Input relay cabinet	PWR	A&PWR	S	PWR	S	S	PWR
Logic cabinet	PWR	A&PWR	S	PWR	S	S	PWR
Output relay cabinet	PWR	A&PWR	S	PWR	S	S	PWR
Balance of Equipment	PWR	A&PWR	S	PWR	S	S	PWR
INVERTERS	PWR	A&PWR	S	PWR	S	S	PWR
REACTOR TRIP SWITCH GEAR							
Switch gear and cabinets	PWR	A&PWR	S	PWR	S	S	PWR
Bus Duct	PWR	A&PWR	S	PWR	S	S	PWR
PROCESS CONTROL SYSTEMS REACTOR COOLANT FLOW							
Rack mounted equipment	PWR	A&PWR	S	PWR	S	S	PWR
Field mounted equipment	PWR	A&PWR	S	PWR	S	S	PWR
Flow elements	PWR	A&PWR	S	PWR	S	S	PWR

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Table A.4-3

SCOPE OF NUCLEAR ENERGY SYSTEMS (NES) PROCEDURES AND INSTRUCTIONS

Criteria of 10CFR50 Appendix B addressed by procedures and instructions.

DESCRIPTION	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII
PWR Quality Assurance and Reliability Manual	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PWR Engineering Policies and Procedures Manual	X		X	X	X	X	X		X						X	X	X	
PWR Purchasing Manual				X		X	X						X		X			
PWR Construction Technology Manual	X						X		X	X	X	X	X		X		X	
PWR Projects Manual			X	X	X	X	X										X	X

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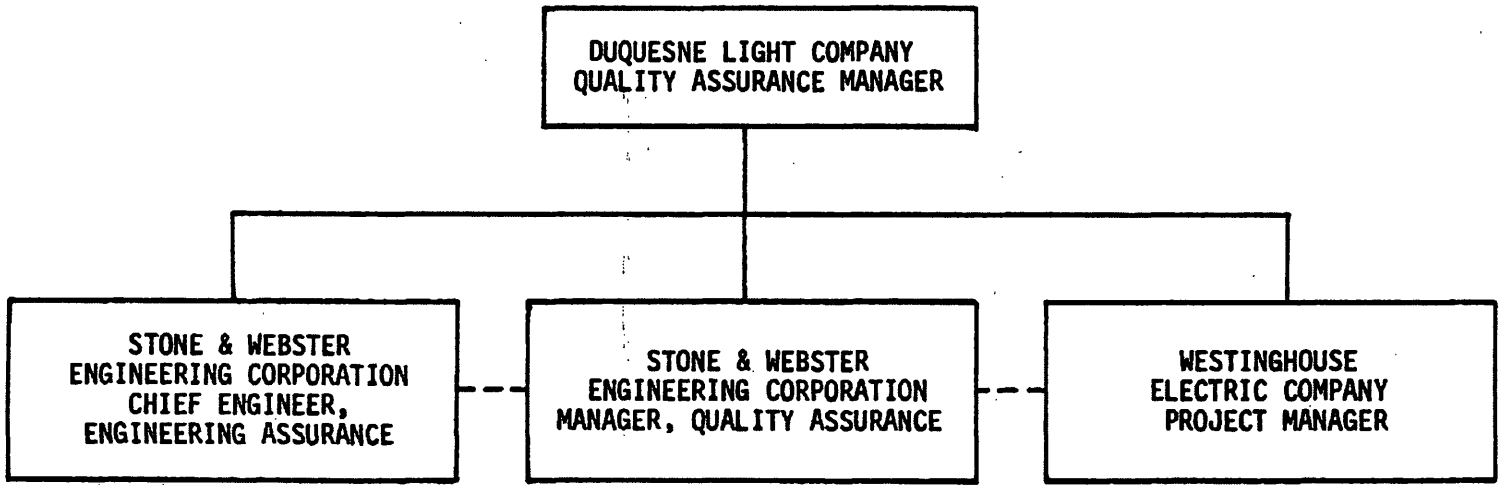

LEGEND:
COMMUNICATION = - - - - - -
RESPONSIBILITY = ————————

FIGURE A-1-1
DUQUESNE LIGHT COMPANY
QUALITY ASSURANCE
PROJECT ORGANIZATION
DESIGN & CONSTRUCTION PHASE
BEAVER VALLEY POWER STATION UNIT NO. 1
UPDATED FINAL SAFETY ANALYSIS REPORT

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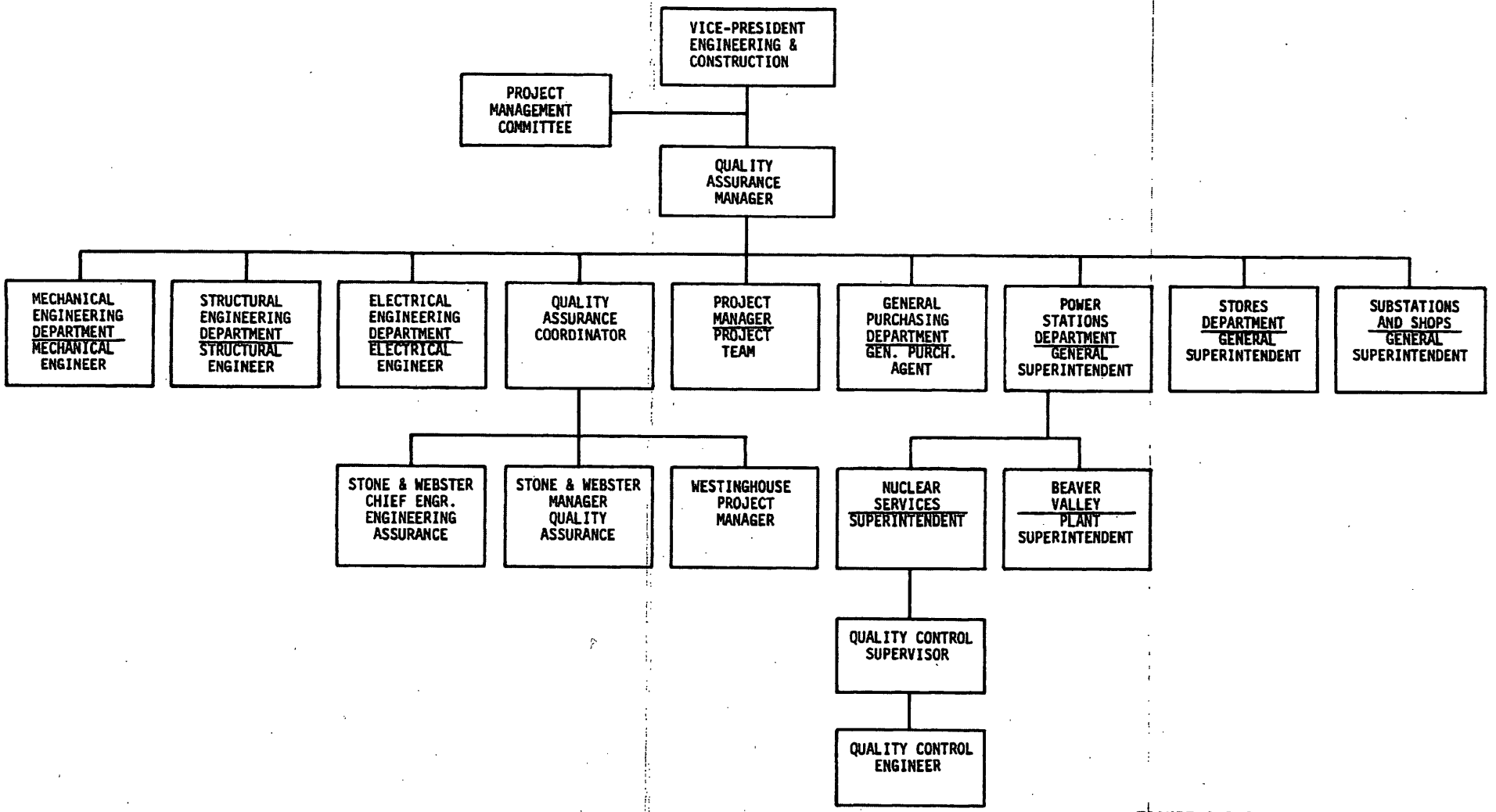

FIGURE A.2-1
DUQUESNE LIGHT COMPANY
QUALITY ASSURANCE ORGANIZATION
DESIGN & CONSTRUCTION PHASE
BEAVER VALLEY POWER STATION UNIT NO. 1
UPDATED FINAL SAFETY ANALYSIS REPORT

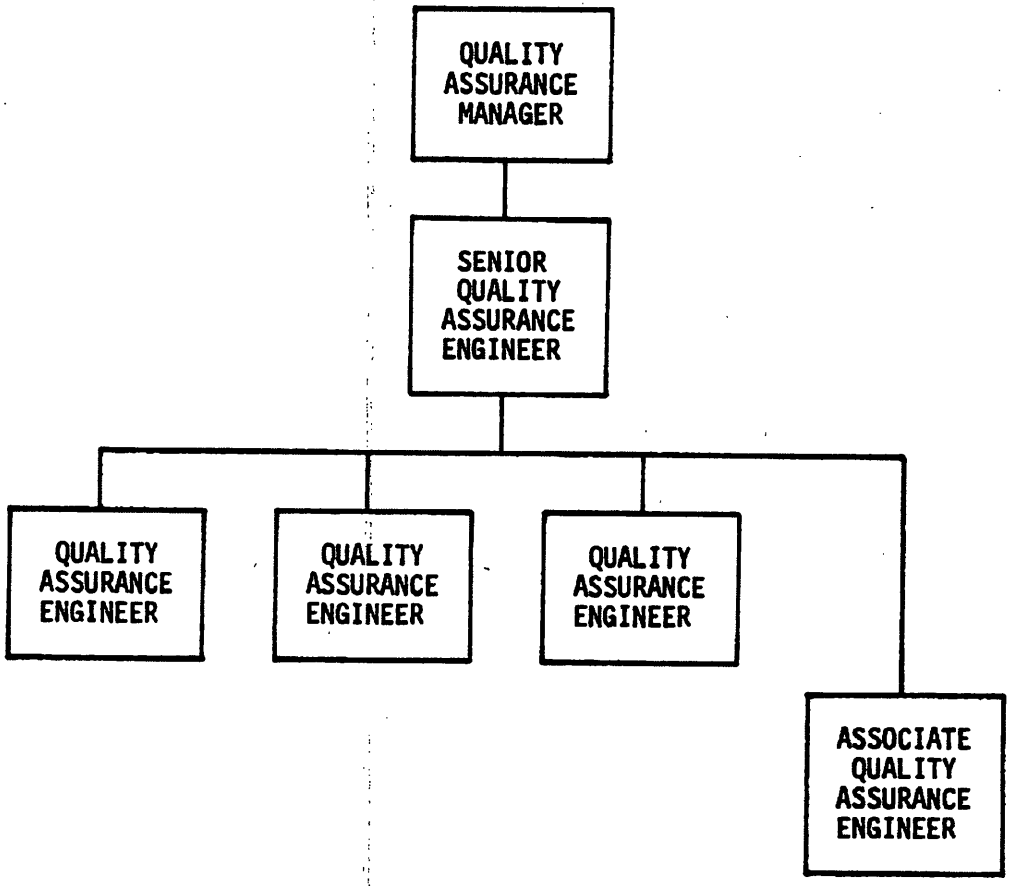

FIGURE A.2-2
DUQUESNE LIGHT COMPANY
QUALITY ASSURANCE DEPARTMENT
DESIGN & CONSTRUCTION PHASE
BEAVER VALLEY POWER STATION UNIT NO. 1
UPDATED FINAL SAFETY ANALYSIS REPORT

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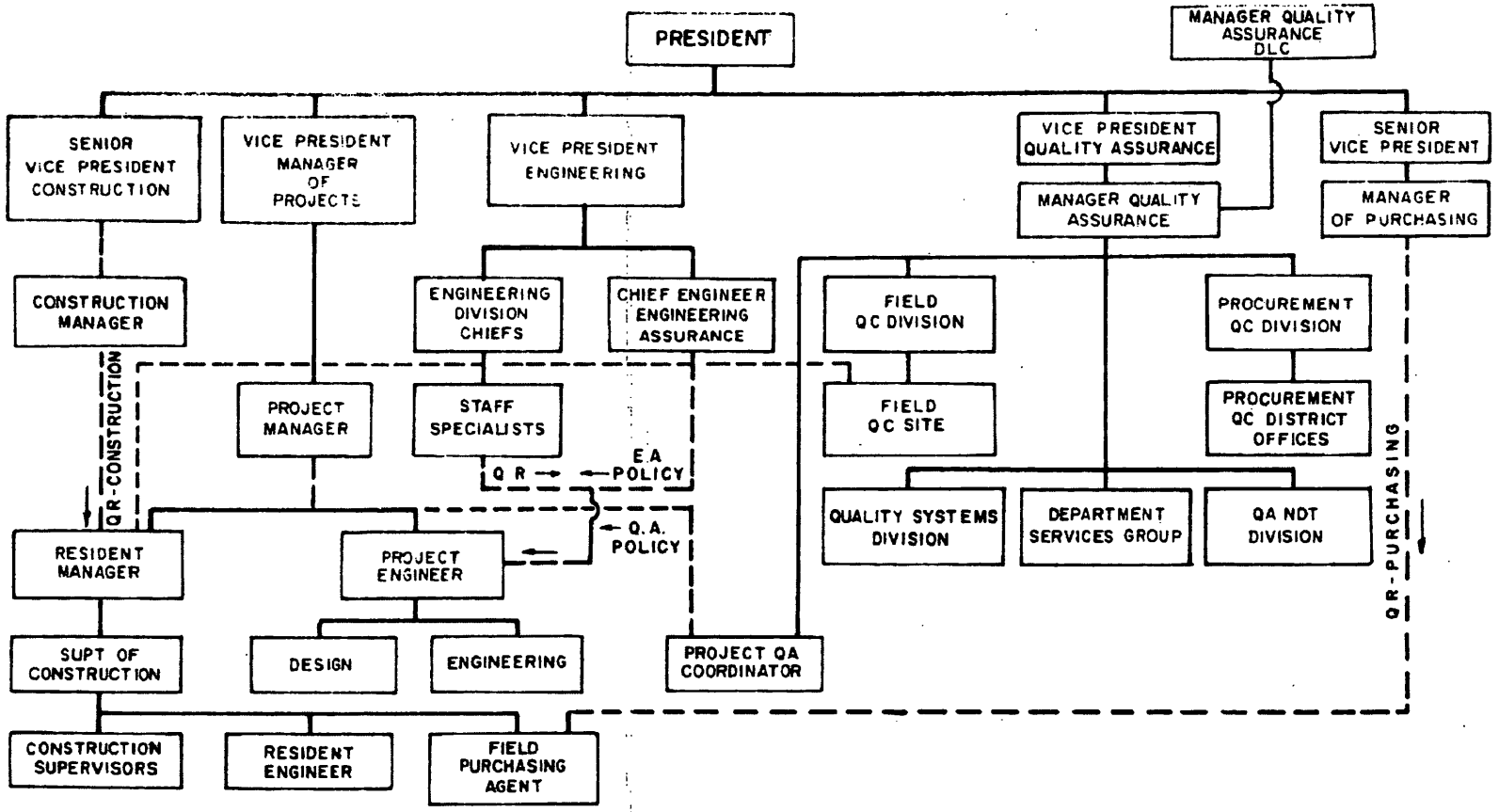

LEGEND
Q R - QUALITY REQUIREMENTS
Q A - QUALITY ASSURANCE
E A - ENGINEERING ASSURANCE
—— DIRECTION
– – COMMUNICATION

FIGURE A.3-1
STONE & WEBSTER
QUALITY ASSURANCE ORGANIZATION
DESIGN & CONSTRUCTION PHASE
BEAVER VALLEY POWER STATION UNIT NO. 1
UPDATED FINAL SAFETY ANALYSIS REPORT

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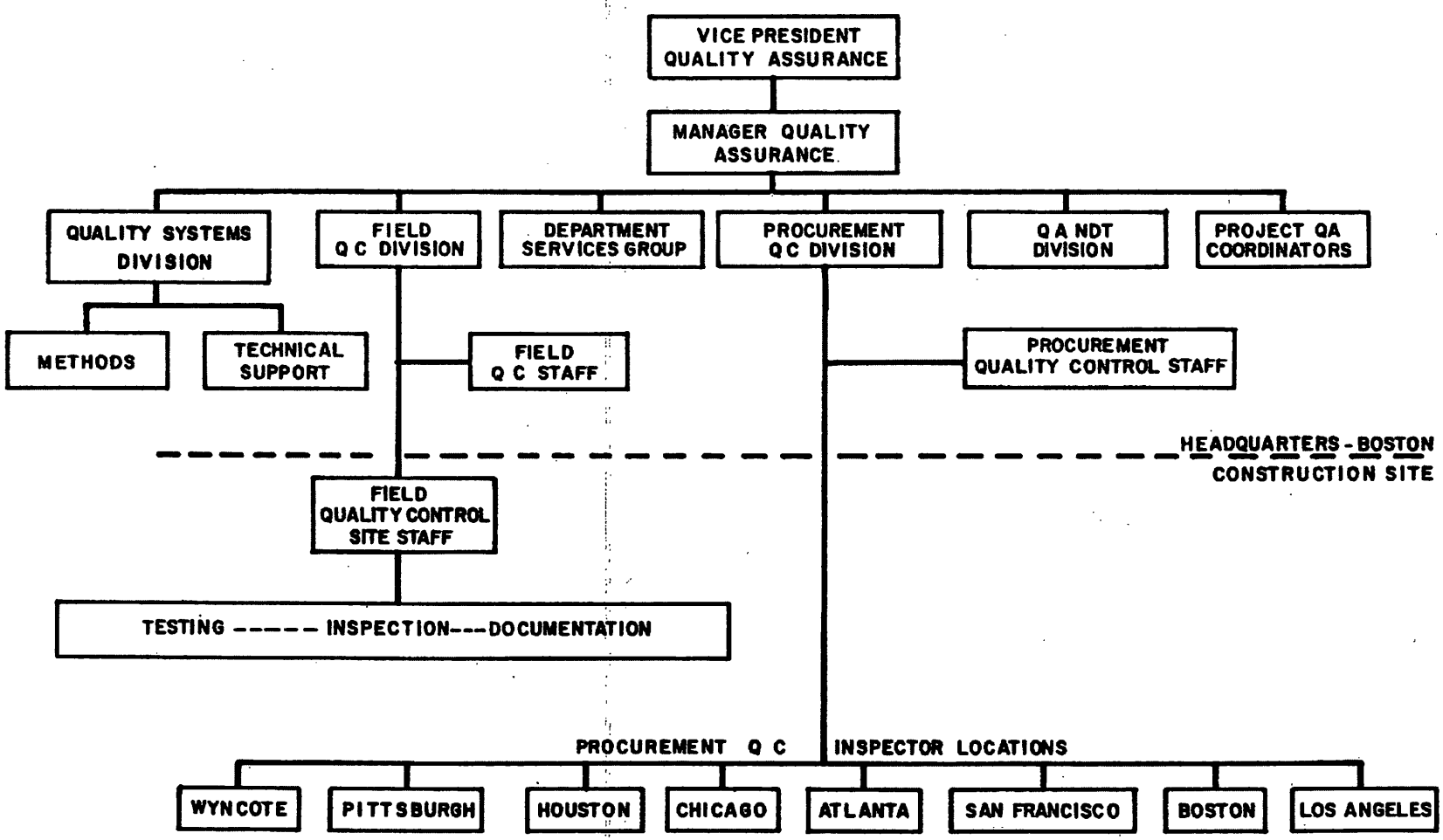

FIGURE A.3-2
STONE & WEBSTER
QUALITY ASSURANCE DEPARTMENT
DESIGN & CONSTRUCTION PHASE
BEAVER VALLEY POWER STATION UNIT NO. 1
UPDATED FINAL SAFETY ANALYSIS REPORT

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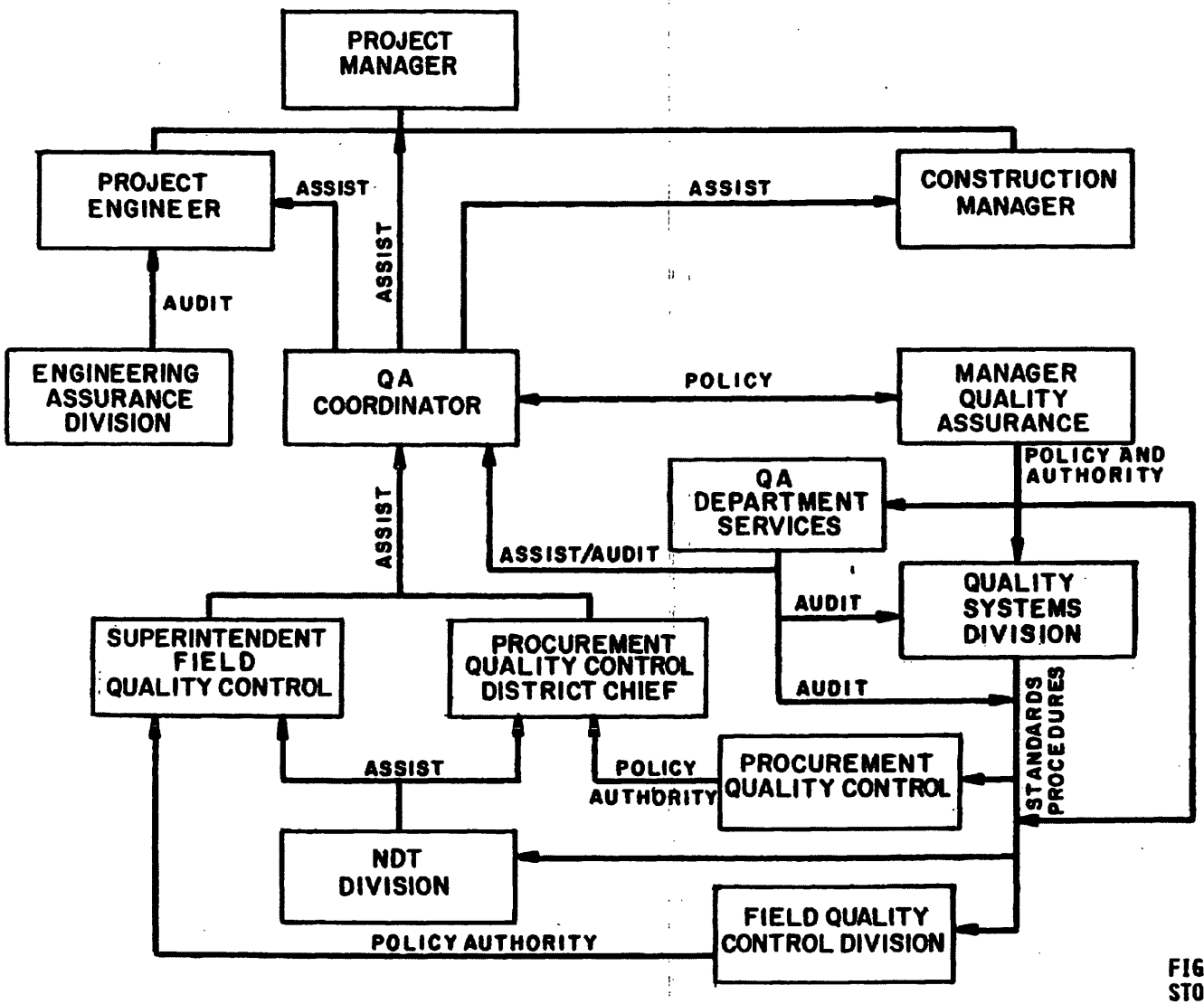
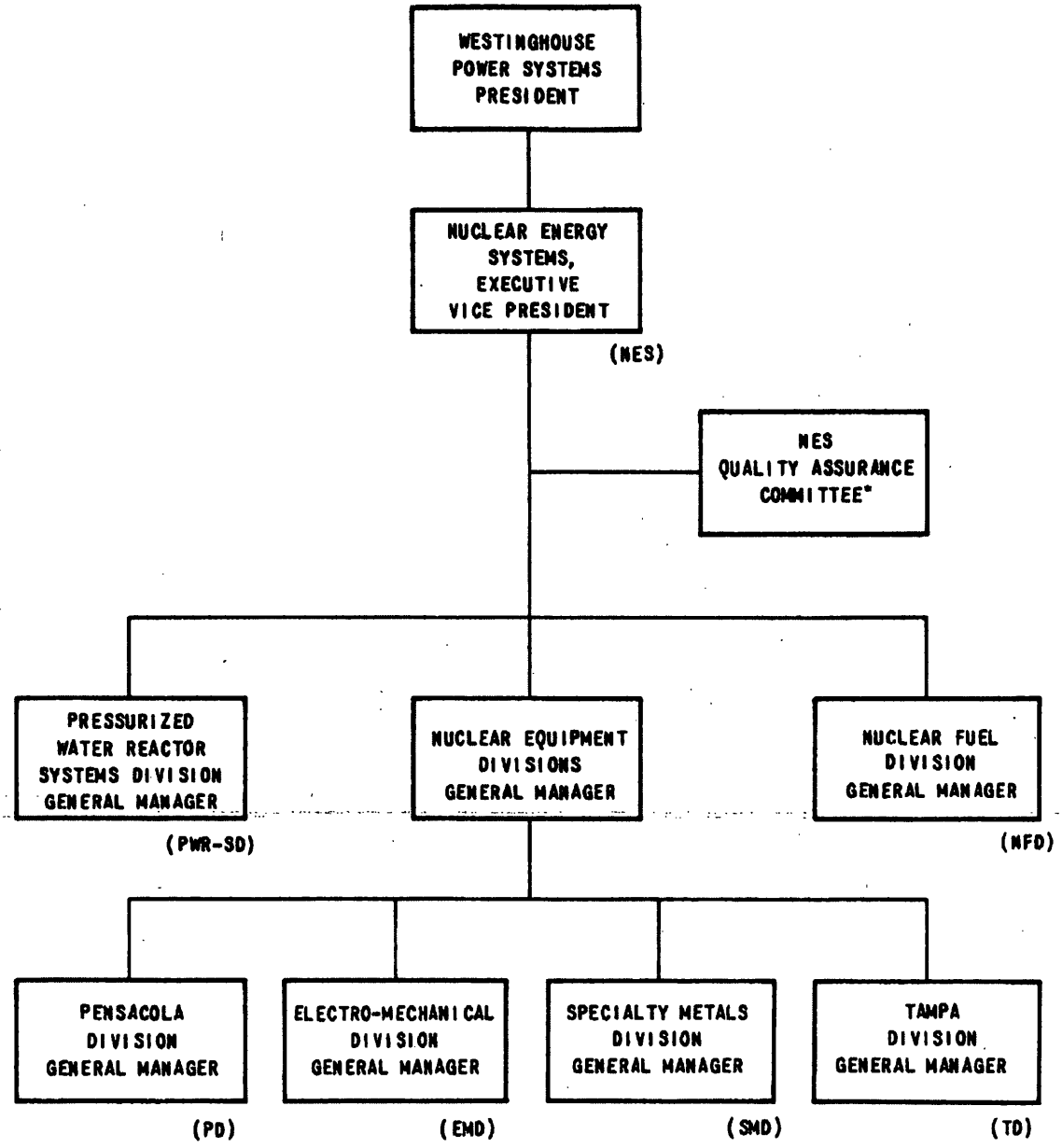


QUALITY ASSURANCE
CLIENT CONTACT
VICE PRESIDENT, Q.A
MANAGER, Q.A.
Q.A.COORDINATOR
PROJECT MANAGER
PROJECT ENGINEER
SUPERINTENDENT FIELD Q.C.

FIGURE A.3-3
STONE & WEBSTER
QUALITY ASSURANCE INTERRELATIONSHIPS
DESIGN & CONSTRUCTION PHASE
BEAVER VALLEY POWER STATION UNIT NO. 1
UPDATED FINAL SAFETY ANALYSIS REPORT

REV. 0 (1/82)



*THE NES QUALITY ASSURANCE COMMITTEE IS COMPOSED OF THE QUALITY ASSURANCE AND RELIABILITY MANAGERS FROM EACH OF THE NES DIVISIONS. THE COMMITTEE'S CHAIRMAN IS THE PWR-SD QUALITY ASSURANCE MANAGER.

FIGURE A.4-1
WESTINGHOUSE POWER SYSTEM DIVISION
NUCLEAR ENERGY SYSTEMS DEPARTMENT
QUALITY ASSURANCE ORGANIZATION
DESIGN & CONSTRUCTION PHASE
BEAVER VALLEY POWER STATION UNIT NO. 1
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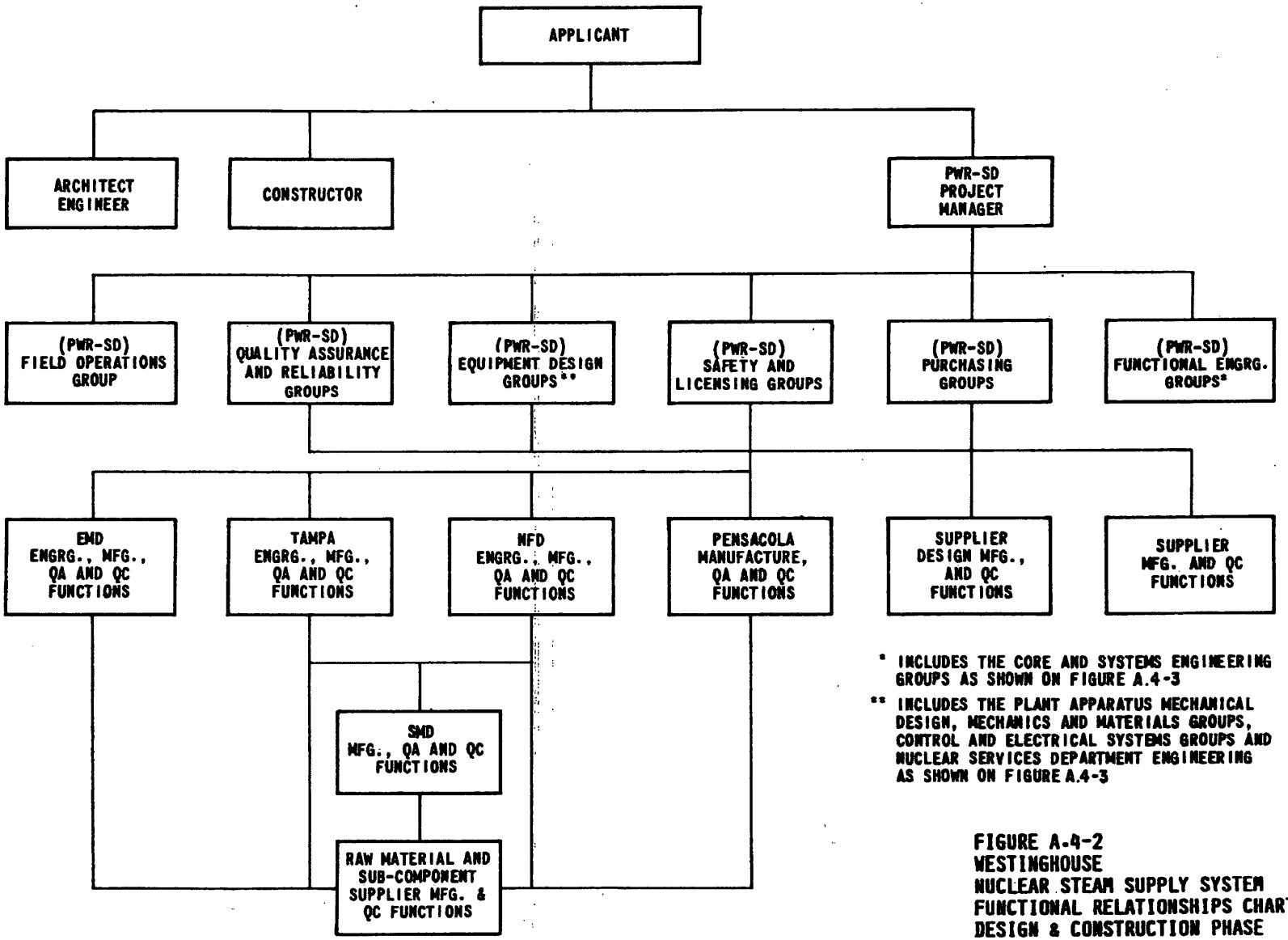

* INCLUDES THE CORE AND SYSTEMS ENGINEERING GROUPS AS SHOWN ON FIGURE A.4-3

** INCLUDES THE PLANT APPARATUS MECHANICAL DESIGN, MECHANICS AND MATERIALS GROUPS, CONTROL AND ELECTRICAL SYSTEMS GROUPS AND NUCLEAR SERVICES DEPARTMENT ENGINEERING AS SHOWN ON FIGURE A.4-3

FIGURE A.4-2
WESTINGHOUSE
NUCLEAR STEAM SUPPLY SYSTEM
FUNCTIONAL RELATIONSHIPS CHART
DESIGN & CONSTRUCTION PHASE
BEAVER VALLEY POWER STATION UNIT NO. 1
UPDATED FINAL SAFETY ANALYSIS REPORT

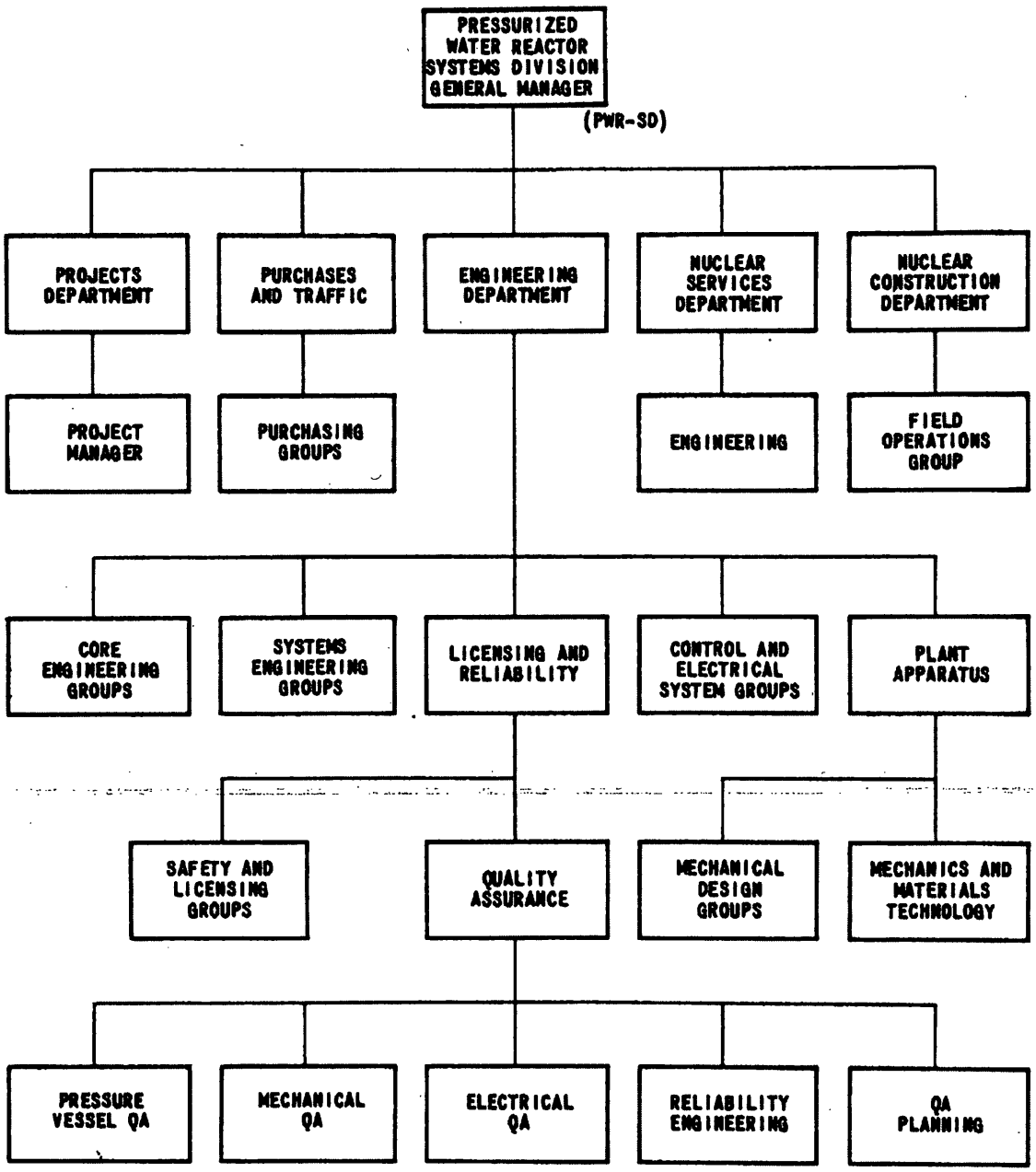

FIGURE A.4-3
WESTINGHOUSE PRESSURIZED WATER
REACTOR SYSTEMS DIVISION
QUALITY ASSURANCE ORGANIZATION
DESIGN & CONSTRUCTION PHASE
BEAVER VALLEY POWER STATION UNIT NO. 1
UPDATED FINAL SAFETY ANALYSIS REPORT