17 QUALITY ASSURANCE

17.1 QUALITY ASSURANCE DURING DESIGN AND CONSTRUCTION

17.1.1 ORGANIZATION

There were four principal organizations active during design and construction in the area of quality assurance to ensure the safety and integrity of the completed plant: RG&E, the applicant-owner; Westinghouse Electric Corporation (Westinghouse), the prime contractor; Gilbert Associates, Inc., the architect-engineer and subcontractor to Westinghouse; and the Bechtel Corporation as constructor and subcontractor to Westinghouse. The direct activities of each organization were in turn supplemented by the quality control activities of other organizations, either in the form of specific subcontracts for this purpose or as a part of their responsibility as a supplier of material or equipment, conforming to specifications. Where one of these organizations did not have the first-line quality control responsibility, a surveillance (auditing and monitoring) function was performed by the contractor in any contractor-subcontractor relationship.

Westinghouse had the prime responsibility to provide all material and equipment for all construction. This responsibility was in turn dispatched through various channels. Westinghouse was the direct supplier of some equipment while in other cases it was supplied by way of purchase from other manufacturers. All of the construction materials and the remainder of the equipment were purchased by either Bechtel or Gilbert Associates. The organization and quality control relationships among these organizations are shown in Figure 17.1-1. The scope and nature of the quality assurance functions of each of these three participants and their relationships to one another are discussed in Sections 17.1.2 and 17.1.3.

17.1.2 QUALITY ASSURANCE PROGRAM

17.1.2.1 General

The quality assurance program for the Ginna project was comprehensive and covered all phases of construction both offsite and onsite. Included were all areas of activity that had influences on plant integrity, including design (drawings and specifications), manufacture and field erection and installation, and all related activities such as cleanliness control, shipment, and storage.

The program placed special emphasis on the reactor coolant and safety systems, the containment, and the other components necessary for the safety of the nuclear portion of the plant. The description that follows delineates the quality assurance organization and procedures but does not repeat the design and specification requirements set forth in the respective system descriptions.

17.1.2.2 Rochester Gas and Electric Corporation

The Rochester Gas and Electric Corporation, from the outset of the R. E. Ginna Project, contributed to quality assurance by continuously examining the plant design, by inspecting major components as they were fabricated, by selecting RG&E personnel with extensive experience and proficiency in specific areas, and by obtaining the counsel of consultants in specialized areas to advise and support RG&E.

For inspection of construction, the RG&E organization consisted of people skilled in mechanical, electrical, civil, instrumentation, piping, and millwright work. They were supplemented when needed by RG&E specialists in welding, radiography, water treatment, and surveying. These people were all directed by the Project Engineer and/or their assistants. In most cases, the lead inspector in each area of work had extensive foreman experience and was to remain in their respective area at the R. E. Ginna plant upon completion of construction.

Upon completion of the plant, records pertaining to quality control and testing during construction were originally intended to become the property of RG&E. However, some records are instead being retained by Westinghouse. These records, or reproductions of them, will be retained for the life of the plant.

Rochester Gas and Electric Corporation field inspectors examined equipment and construction for cleanliness, workmanship, maintainability, and operability. The primary purpose, however, of the RG&E inspection was to independently audit and monitor the quality control program established by the prime contractor, Westinghouse. In addition, the Project Engineer had the authority to stop work in any area that was considered to be a problem and could therefore affect the adequacy or safety of the plant.

Rochester Gas and Electric Corporation personnel both from the field organization and from the operations supervisory group took part in the inspection of components in the fabrication shops.

For review of the quality control program related to the primary system, RG&E retained Southwest Research Institute, thus providing an independent quality assurance program. This review included all primary system components including those manufactured by Westinghouse. Southwest Research Institute made visits to fabrication shops as an RG&E agent, and reviewed radiographs, ultrasonic tests, etc. They also examined physical and chemical certificates as to compliance with specifications and standards. Written reports of all Southwest Research Institute surveillance visits were forwarded to both RG&E and Westinghouse.

A compilation of the location and a description of all the quality control and inspection records for the primary system has been assembled.

Each system and its components were evaluated by an acceptance test that was written cooperatively by RG&E and Westinghouse personnel. Each acceptance test and the acceptance of the data from the test as satisfactory had to be approved by both the RG&E project manager and plant supervisor before a system was accepted by RG&E. Not until formal acceptance testing was satisfactorily completed was the plant fully accepted by RG&E.

17.1.2.3 Westinghouse

17.1.2.3.1 General

In the capacity of prime contractor, Westinghouse was responsible for providing all material and equipment and for all construction. In discharging this responsibility, Westinghouse recognized the importance of quality assurance throughout all stages of design, fabrication, and construction, and accordingly maintained a comprehensive overall quality control program. This program ensured that design, engineering, materials, and workmanship employed in the fabrication and construction of the facility met safety, operability, maintainability, and reliability objectives previously established. Particular emphasis was placed on the nuclear steam supply system and other critical features.

Records and documentation pertinent to the required quality of materials, workmanship, and testing were maintained by the Westinghouse Quality Control and Reliability Section.

17.1.2.3.2 Westinghouse Organization

The organization chart for Westinghouse relating to quality control is shown in Figure 17.1-1.

Component design and quality control groups had the responsibility for ensuring offsite quality control, i.e., up to and including component fabrication and dispatching for shipment.

The Manager of Quality Control and Reliability was responsible for establishing and implementing the overall quality control program through three specialized quality control units each headed by its own manager. There were two mechanical quality control groups: one was responsible for vessels and tanks and the other was responsible for the balance of the mechanical equipment. There was also a quality control group for all electrical instrumentation and control equipment. There were senior quality control engineers in each unit who had expertise in specific categories of equipment and who carried out the quality control engineering planning. These engineers, supplemented by the efforts of quality control representatives, also conducted surveillance of the suppliers.

The Nuclear Power Service group had the responsibility for ensuring onsite quality control, i.e., from receiving all equipment and materials onsite, through erection, to plant startup.

All of the groups were staffed by capable and experienced engineers who collectively provided the experience and effort to implement the overall quality control plan to ensure the quality of the finished plant.

17.1.2.3.3 Components Supplied By Westinghouse

All major components were supplied by Westinghouse, either directly through the Westinghouse equipment manufacturing division or by way of purchase from other manufacturers.

There were four stages in the quality control program during component fabrication to ensure the required degree of quality of the finished product. They were as follows:

A. Supplier evaluation.

B. Equipment specifications.

C. Purchase order review.

D. Supplier surveillance during fabrication.

17.1.2.3.4 Supplier Evaluation

An evaluation of prospective suppliers was conducted prior to award of a contract for important components. This evaluation established that the supplier had acceptable design, manufacturing, and quality control capability. Elements considered in conducting the evaluation included:

- Previous experience with the supplier.
- Physical plant facilities.
- Quality control program.
- Personnel qualifications.
- Material control and inspection.
- In-process inspection.
- Assembly and test capability.
- Tool and gage control.
- Special processes required.
- Nondestructive testing.
- Inspection and test equipment.

Responsibility for this evaluation was a function of the quality control groups.

17.1.2.3.5 Equipment Specifications

Individual equipment specifications covered all aspects of equipment design, manufacture, inspection, and testing. For Seismic Category I components, such as those in the reactor coolant system, a specification that defined the supplier's quality control requirements was made a part of each purchase order. Specific requirements included:

- Drawings and change procedures.
- Procedures and revisions covering welding, heat treating, and other process control documents.
- Inspection plans covering contracted and subcontracted work.
- Identification and disposal of nonconforming material or components.
- Quality control records.
- Material control.

These requirements were similar to those of Appendix IX to Section III of the ASME Boiler and Pressure Vessel Code.

Responsibility for ensuring conformity with these requirements was a function of the quality control group.

17.1.2.3.6 Purchase Order Review

Purchase orders, including the applicable drawings, welding specifications, nondestructive test procedures and other process control documents required to manufacture, inspect, and test the equipment were reviewed by Westinghouse engineering and material personnel to make sure they included all contract requirements, met applicable codes and quality control requirements, and were compatible with the supplier's capabilities. In cases where existing inspection techniques were found to be inadequate to ensure requisite quality, discussions were held with the engineers concerned, and the necessary adjustments were made. This procedure was applied to all types of material and components and provided the means for maintaining surveillance over the quality of procurements.

17.1.2.3.7 Supplier Surveillance

The design engineer/quality control engineer team developed specific quality control plans that detailed the inspections, surveillance, and record verification that Westinghouse quality control personnel performed in suppliers' plants. They covered the entire cycle from purchase order placement through manufacture, inspection, and test. These plans were developed as follows.

The many requirements of the equipment specification and its referenced specifications that establish the quality of equipment were listed in a Quality Requirements Summary for each category of equipment. This served as a working tool from which the Westinghouse quality control plan was developed. This quality control plan was the action plan which detailed the inspection and surveillance done by Westinghouse quality control engineers and field representatives in the suppliers' shops. It covered the auditing of the suppliers' quality control organizations, systems, and procedures; surveillance of key shop operations such as welding, nondestructive testing, and production testing; specific inspections such as radiographic, ultrasonic; material test reports; key dimensions; and other important requirements.

The design engineer also visited the suppliers' plants periodically and monitored overall compliance with specification requirements. Particular emphasis was placed on inspections of the first units of fabricated new designs and from new suppliers.

Through the Westinghouse visits to the suppliers' plants, the suppliers' quality control system, in-process work, testing, and records were evaluated to ensure that they met contract requirements. The extent of surveillance performed in a supplier's facility depended on the complexity of the component, the supplier's past performance, the observed effectiveness of the supplier's own quality control procedures, the relative importance with respect to safety of the component being fabricated, and whether the component was of an established or new design. The quality control plan emphasized the basic responsibility of the supplier to have systems and procedures to meet the requirements of the specifications and drawings and to control the quality of their product. The supplier was required to inspect and test their products and to furnish objective evidence that control requirements had been met. Direct evidence of performance was obtained by audits of critical areas by Westinghouse quality control representatives. For example, close attention was given to welder qualification to ASME Code, nondestructive testing records of both supplier and subvendor, and records of heat treating.

The Westinghouse auditing of in-process control was aimed at minimizing or preventing defects or errors during fabrication. In the case of the reactor vessel, Westinghouse had a full-time resident inspector at the manufacturing facility.

Each supplier was required to inspect and test their products and to furnish evidence that all requirements of the contract had been met. This evidence included proof of (1) conformance to specifications for raw materials and those manufacturing steps through which they had passed, (2) the acceptability of manufactured and purchased items, and (3) the accuracy of all test equipment used in evaluating product quality. Westinghouse quality control engineers and representatives reviewed the supplier's quality control procedures and recordkeeping for conformance to Westinghouse requirements. Critical examination was made of the supplier's quality control records, reports, and inspection certificates gathered during production. Direct evidence of conformance was obtained by auditing of samples of the supplier's product inspection.

In this manner, Westinghouse determined whether or not a supplier had met the specified requirements through the use of objective evidence which was obtained by or from the supplier, and then verified and evaluated by Westinghouse inspection engineers.

17.1.2.3.8 Instrumentation and Control Equipment

Instrumentation and control equipment, such as relay racks, circuit breakers, inverters, analog protection racks, and sensors were available from qualified suppliers who had previously provided equipment to Westinghouse for nuclear plant application. For equipment of this type, Westinghouse quality surveillance consisted of preproduction inspection of component parts, and inspection during manufacture, assembly, and testing. Where required, Westinghouse technical personnel assisted the manufacturers in specific problem areas and worked with their engineers on detailed design, as well as ensuring that design requirements, such as the Proposed IEEE Standard 279 - "Criteria for Protection Systems for Nuclear Power Plants," were being followed.

In general, production testing was performed per manufacturers' standard test procedures. Where considered necessary, these procedures were augmented by Westinghouse-furnished procedures. As applicable to the specific equipment, production unit testing was performed to determine such things as:

- Compliance with engineering specifications.
- Proper operation.
- Susceptibility to noise.
- Compliance with voltage and frequency specifications.
- Ability to align and calibrate.
- Stability.
- Time response.

In addition to Westinghouse coverage of production and verification tests, coverage was also provided by RG&E and Gilbert Associates, Inc., as in the case of loading and operational testing of the emergency diesel generators.

Advances in technology associated with some systems' designs resulted in developmental work that required closer supervision and assistance from Westinghouse Nuclear Energy Systems Division technical personnel. This included such systems as rod control.

These changes in technology brought about new concepts and new component design that improved the reliability and operation of the systems. Qualified suppliers were selected to develop detail designs and breadboard models for evaluation and testing. This developmental work was essentially under constant surveillance of Westinghouse Nuclear Energy Systems Division technical personnel. Complete preproduction testing under the direction of Westinghouse Nuclear Energy Systems Division was performed in accordance with approved test procedures to verify the design in such areas as:

- Operating characteristics and compliance with specifications and standards.
- Time response.
- Linearity.
- Accuracy.
- Noise susceptibility.
- Reliability.
- Compatibility with other systems.
- Endurance under prolonged operating conditions.

After completion of manufacturing tests and acceptance by Westinghouse, the equipment designated for installation in the plant received a complete inspection prior to shipment to the plant site. Following receipt at the site, it received a receipt inspection and was placed in controlled storage until ready for installation in the plant, or was immediately installed in the plant. All equipment received at the plant came under the surveillance and overall control of onsite Westinghouse technical personnel.

17.1.2.3.9 Shipment of Components

The detailed requirements for preparing equipment for shipment were included in the equipment specifications. These included sealing of all openings, protection of nozzle preparations, the use of desiccants if required, etc. Where required, the suppliers submitted detailed plans for review and approval.

The reactor vessel supplier provided a cover and seal system to protect all internal surfaces and external stainless steel and machined surfaces from exposure to ambient environments during shipment, storage at the site, and installation. The protective means consisted of pressurized inert gas with covers.

For the reactor internals, the lower assembly was shipped on an up-ending skid, shock-mounted to limit loads transmitted to the assembly during shipment. Prior to installation onto the skid, the lower internals were wrapped in a plastic film and sealed. Internal bracing was used inside the assembly. The upper internal assembly was shipped in a shock-mounted, dual-purpose shipping assembly stand in the vertical position. This package was also wrapped and sealed in a plastic film. Both the skid and the stand had a protective metal covering to provide weather protection and long-term storage protection at the site.

All other components had protection, as required, against mechanical or environmental damage during shipment and/or site storage.

17.1.2.3.10 Inspection and Installation of Equipment in the Field

For components and equipment supplied by Westinghouse or its subcontractors, specifications were prepared not only for design manufacturing, cleanliness requirements and shipment, but also specifications and procedures were provided for onsite storage, erection, quality control, and testing.

During component installation, Westinghouse Nuclear Power Services provided a capable and experienced group of specialists to monitor all construction-related activities on the nuclear steam supply system, engineered safeguards, and Seismic Category I structures. This group was staffed to provide coverage in all phases of construction such as welding, mechanical erection, electrical systems, and instrumentation and control, installation, and startup.
The primary responsibility of this staff was to ensure proper erection of the nuclear steam supply system, engineered safeguards, and critical structures as outlined by Westinghouse specifications and procedures. This surveillance included visits to selected shops of suppliers and to the architect-engineer and constructor to ensure that established procedures of inspection and documentation were properly followed. Secondary functions of this staff were to provide technical direction and assistance to the constructor during critical operations and to ensure that adequate documentation was being maintained.

The Nuclear Power Services staff was augmented by a headquarters-assigned quality assurance group. This group, staffed by specialists experienced in various fields such as mechanical, civil, electrical, and shop manufacturing, provided additional backup for the onsite staff. Numerous functions were assigned to this group and included construction site audits, non-Westinghouse vendor surveillance, follow-up on critical operations or problems, and maintenance of a field reliability program for disposition of deficient material or operations.

During the frequent site audits by the headquarters quality assurance staff, particular attention was directed toward critical work and those procedures which could seriously affect the safe operation of the plant. Although critical operations were of utmost importance, the group attempted to survey all construction activities. Typical audits included review of concrete inspection activities and surveillance of concrete placement operations, reinforcing steel users' tests, tendon installation, soil compaction, containment liner erection and testing, receiving inspection, storage operations, welding operations, equipment installation, site testing, and review of quality control files for adequacy.

The site reliability program was a method by which deficiencies were reported on Field Deficiency Reports and transmitted back to headquarters for disposition. The reports were transmitted to cognizant engineering personnel for their review and decisions. Instructions for corrective action were entered on the same form and sent back to field personnel. Field Deficiency Reports were then closed out. In addition to providing a controlled method for correcting deficiencies, the program also served to alert other field personnel and prevent reoccurring deficiencies.

Another function performed by the headquarters quality assurance group was to provide vendor surveillance on non-Westinghouse purchased equipment. Various suppliers were audited during construction, and visits varied from brief evaluation visits (piping supplier) to residency for one particular operation (reactor cooling pads and reactor support pedestals).

17.1.2.3.11 Nonconforming Components or Material

All nonconforming components or material, whether discovered at a supplier's facility or at the construction site, were documented, reviewed, and disposed of as follows: All details pertinent to the nonconformity were shown on applicable forms. In all cases, the nonconforming component or material was positively identified and separated from acceptable items or items awaiting inspection. All cases of nonconforming components or material were reviewed by Westinghouse design and quality control engineers for resolution. Westinghouse's management was kept informed of all cases of major importance with recommendations for proper disposition.

17.1.2.3.12 Quality Control Records

A complete set of quality control records was maintained for each component by its manufacturer and/or purchaser and preserved for Westinghouse. These records included certified test reports, letters of compliance, product inspection reports, nondestructive test reports, and reports of nonconforming material. Records of personnel, procedures, and equipment qualifications were also maintained as required by Westinghouse's specifications. Records for the components were transmitted periodically to Westinghouse so that all required data would be available for the completed plant.

17.1.2.4 Gilbert Associates, Inc.

Gilbert Associates, Inc., was the architect-engineer for the plant and, as such, acted as subcontractor to Westinghouse.

In the areas of the nuclear plant, especially as related to safeguards, the scope of work lay primarily in the design and field monitoring of the containment. A comprehensive description of the responsibility for this aspect of the work is included in Section 17.1.3. As stated in Section 17.1.3, Westinghouse as prime contractor was fully responsible for all aspects of quality control including plant design, construction, materials, workmanship, and performance. Due to this requirement, Westinghouse reviewed, commented upon, and approved all drawings and specifications prior to issue for construction and/or purchase.

Gilbert Associates, during the course of the work for Westinghouse, performed the following additional tasks:

A. Included in the specifications and drawings the quality and capability required in the end product, be it work, equipment, or materials. Special precautions and procedures together with applicable codes, if in existence, were clearly identified.

B. Requested in the specifications detailed procedures on the execution of the work outlined in the specifications and drawings. Procedures received from Westinghouse or Gilbert Associates' vendors were reviewed for adequacy against the requirements of the specifications.

C. Upon request, interpreted drawings and intent of design and adjusted design to field conditions.

D. Accumulated required test certificates and forwarded same to Westinghouse.

E. Received from Westinghouse results of tests performed by the testing agency (Pittsburgh Testing Laboratory) and reviewed test results on concrete (including ingredients) and rebar splices. Material test reports received from Westinghouse and from vendors in those limited areas where Gilbert Associates had purchasing responsibility were reviewed for adequacy against the requirements of the specifications.

F. Witnessed shop running tests to ensure performance requirements of equipment.

17.1.2.5 Bechtel Corporation

17.1.2.5.1 General

As constructor, Bechtel Corporation was responsible for the quality of the work performed in the field and the quality of materials and equipment procured by Bechtel for field use. The scope of this responsibility included quality of work performed by both Bechtel and subcontractor field forces. The quality control program in the field was broken into three categories as follows:

I. Material certification.

II. Field surveillance.

III. Documentation.

To carry out this program, Bechtel maintained a field engineering organization answering directly to the Project Superintendent and working with the construction supervision organization (Figure 17.1-1). This field engineering organization reviewed construction work, installation work, and planning to ensure conformance with technical requirements as outlined in the engineering plans and specifications and maintained an engineering file that documented technical data and special items of work.

The following sections present a review of some of the specific areas and the nature of Bechtel's quality control activities.

17.1.2.5.2 Material Certification

Material purchases by Bechtel were initiated by the department senior engineer (mechanical, electrical, civil) who was responsible for ensuring that proper material certification was specified to the vendor. The material certificates (physical analysis, chemical analysis, conformance, etc.) were received by the Bechtel field purchasing department and submitted to the appropriate senior engineer who reviewed them for acceptability. Copies of the certifications were retained in the field technical files and also forwarded to Gilbert Associates and Westinghouse for approval.

17.1.2.5.3 Backfill

Westinghouse Atomic Power Division retained the services of Pittsburgh Testing Laboratory to observe, test, and report on backfilling operations. Pittsburgh Testing Laboratory submitted the following reports for review by the Bechtel senior civil engineer and the Gilbert field engineer:

A. Moisture-density relationship of soil.

B. Report of in-place soil density tests.

17.1.2.5.4 Containment Liner

The containment liner was erected by the Chicago Bridge and Iron Company under subcontract to Bechtel. There was a full-time Chicago Bridge and Iron Company quality control engineer onsite during major phases of work carried out by Chicago Bridge and Iron Company. The Quality Control Engineer was responsible for visual inspection of fit-up and welding, and performing the required nondestructive tests.

Chicago Bridge and Iron Company operations were monitored by the Bechtel quality control engineer and the Gilbert field engineer.

17.1.2.5.5 Piping

Pipe welding procedure and performance qualifications were administered by the Bechtel welding engineer. The Engineer maintained the required records. The testing and records were reviewed by the Westinghouse Nuclear Power Services welding engineer.

A log of production welds was maintained by the Bechtel welding engineer. A Daily Inspection Record-Critical Pipe Joint Welding was also maintained by the Bechtel welding engineer.

Production welds were inspected visually, with liquid penetrant, and by radiography. The penetrant test was witnessed by the welder's foreman and checked on a sample basis by the Bechtel welding engineer and the Westinghouse Nuclear Power Services welding engineer.

Bechtel retained the services of Pittsburgh Testing Laboratory to radiograph and interpret radiographs. Radiography was performed on a sample basis. Radiographs deemed acceptable by the Bechtel welding engineer were submitted to the Westinghouse Nuclear Power Services welding engineer for final acceptance.

17.1.2.5.6 Stainless Steel Liners

Welding procedure and performance qualifications, production welding, and testing of completed welds were carried out under the surveillance of the Bechtel quality control engineer.

17.1.2.5.7 Containment Tendons

Containment tendons were installed by Joseph T. Ryerson & Son, Inc. and their subcontractors in accordance with approved procedures as modified by field requirements (such modifications were subject to approval).

The installation of tendons was monitored by the Bechtel quality control engineer, the Gilbert field engineer, and in part, by the Westinghouse Atomic Power Division assistant resident engineer.

17.1.2.5.8 Reinforcing Bar and Cadwelds

Mill test reports of reinforcing bar were handled as outlined in Section 17.1.2.5.2. Bechtel retained the services of Pittsburgh Testing Laboratory to perform and report on user's tensile tests on representative randomly selected samples of reinforcing bar stocked at the site. The random selections of samples to be tested were made by the Bechtel senior civil engineer.

17.1.2.5.9 Machinery Setting and Alignment

Bechtel millwrights recorded alignment data during initial machinery alignment. This data was maintained in Bechtel files. Machinery was not coupled at initial alignment. Immediately prior to startup, alignment was rechecked and data recorded; vibrometer readings were taken on driver and driven elements.

17.1.2.5.10 Concrete

Placement of concrete was carried out under the supervision of a Bechtel engineer who was responsible for variations in the water/cement ratio, within the limitations of the specifications. The Engineer was responsible for the acceptance or rejection of the concrete prior to placement.

Westinghouse Atomic Power Division retained the services of Pittsburgh Testing Laboratory for concrete quality control.

Pittsburgh Testing Laboratory monitored and reported on the following:

- Cement chemical analyses.
- Cement physical analyses.
- Water analyses: pH, total solids, chlorides, sulfates.
- Sand sieve analyses.
- Concrete mix design.
- Aggregate tests.
- Visual inspection of hardened concrete in mixing trucks.
- Report of batch plant operations.
- Pertinent data at Manitow Walworth Batch Plant.
- Pertinent data of concrete truck mixing.
- Report of test cylinders made.
- Concrete test report.

During concrete operation, Pittsburgh Testing Laboratory technicians were located at the batch plant and at the job site to test and monitor the concrete batching, mixing, and placement. Anomalies were brought to the attention of the Bechtel engineer and rejection of concrete was recommended as appropriate. Running statistics of concrete tests were maintained by the Bechtel Civil Department. These were reviewed by the Gilbert Associates field engineer.

17.1.2.5.11 Documentation

Bechtel maintained a field technical file organized on the code of account system. Maintenance of these files was the direct responsibility of the Bechtel job engineer and responsibility for content portions of the file (civil, electrical, mechanical) was delegated to the respective senior engineers. Records, certificates, and test reports accumulated in the areas discussed in Sections 17.1.2.5.2 through 17.1.2.5.10 above were retained in the technical files along with the correspondence and engineering data pertaining to the various areas. The technical files represented a complete record of the technical aspects of the job and were turned over to Westinghouse Atomic Power Division upon completion of the job.

17.1.2.5.12 Site Cleanliness

Bechtel was responsible for maintaining general site cleanliness both inside and outside of structures throughout the construction period. A receiving warehouse was maintained on the site for storage and protection of all but the large equipment received at the site. All packing and temporary construction material was removed from the site immediately following completion of their use. Clean areas were constructed where needed, and cleanliness of adjacent areas was maintained to reduce the probability of contamination of clean areas and nuclear steam supply system components.

17.1.3 QUALITY CONTROL ORGANIZATION FOR REACTOR CONTAINMENT STRUCTURE DESIGN AND ERECTION

17.1.3.1 General

The Westinghouse Electric Corporation, as prime contractor, was fully responsible to RG&E for all aspects of quality control of the project including design, construction, materials, workmanship, and performance. Westinghouse assigned certain responsibilities for quality control as described hereinafter. Generally all test, inspection, and installation records were kept in a quality control file maintained at the site.

17.1.3.2 Rochester Gas and Electric Corporation

The Rochester Gas and Electric Corporation assigned company inspection personnel to ensure that construction was in accordance with drawings and specifications. The assigned inspection personnel were under the direction of the Project Engineer who was a licensed professional engineer in the State of New York. The inspection staff consisted of, at a minimum, a mechanical engineer who was responsible for hardware and a technician from the RG&E construction department experienced in concrete construction. Rochester Gas and Electric Corporation also retained the firm of Hansen, Holley and Biggs, consulting engineers, who reviewed the design of the containment and advised the RG&E field staff on special areas for field inspection. Rochester Gas and Electric Corporation's assigned personnel reviewed the inspection and quality control records maintained by Westinghouse in the field and reviewed the results of tests conducted on construction materials and work performed in the field.

17.1.3.3 Westinghouse Electric Corporation

In addition to its overall project responsibility, Westinghouse performed the following to ensure plant integrity and quality.

A. The containment design criteria, material specifications, and detail design were reviewed by qualified engineers of the home office engineering department prior to releasing drawings and specifications for construction. The containment design was also independently reviewed by the firm of Praeger-Kavanagh-Waterbury.

B. Methods proposed by the constructor, Bechtel Corporation, were reviewed prior to using them for construction and inspection.

C. An up-to-date file was maintained of all change orders, test reports, and inspection reports on field-procured materials and construction work.

D. Continuous surveillance was maintained of all construction and inspection operations.

The responsibilities and authority of Westinghouse on the construction site were vested in the Westinghouse resident engineer who was a qualified engineer with more than 10 years experience in the construction of power plants. In addition, the overall program of quality control was coordinated with other Westinghouse construction projects by the construction quality control engineer in the home office who was a qualified civil engineer with more than 5 years experience in both field construction and shop fabrication of mechanical equipment.

17.1.3.4 Gilbert Associates, Inc.

As designer of the containment, Gilbert Associates, Inc., provided the services of a field engineer to maintain continuous surveillance of construction. The function of the field engineer included interpreting drawings and specifications and ensuring that construction changes were properly documented and referred to the home office designers for resolution. The field engineer reported directly to the Westinghouse resident engineer on field matters and to the project engineer on matters of drawing or specification interpretation and construction changes. Specific responsibilities of this field engineer were as follows:

Materials

The field engineer reviewed all required materials test reports including those for concrete, mild steel reinforcement, tendons, liner including penetrations, elastomer pads, and other embedded materials. Materials delivered to the field were randomly checked for damage in transit and other imperfections. The work of the concrete testing agency was monitored, and information contained on concrete test reports was monitored for correctness and completeness. The field engineer selected cadweld splices for sampling and monitored test results to verify that they did not fall below the decision limit established for the statistical sampling.

Workmanship

The field engineer monitored and duplicated where necessary the Constructor's (Bechtel) routine inspection of the work. The operations of the personnel of the concrete testing agency on the site were monitored to ensure that required coverage of concrete operations was provided. Random inspection of the concrete batch plant, including its operation and materials, was made. The testing of the liner, including nondestructive tests and leak-rate tests, was monitored to ensure that test procedures and results conformed to the specifications. The placement of liner, mild steel reinforcement, cadweld splices, tendons, concrete, and other embedded materials was monitored to ensure compliance with the design. The field engineer ensured that the competence of the foundation material was verified by a soils engineer from Dames & Moore prior to placing the foundations. Procedures and sequence of tendon tensioning were monitored.

17.1.3.5 Pittsburgh Testing Laboratory

This firm maintains testing laboratories in many cities including both Rochester and Buffalo, New York. They provided to Westinghouse the services of inspection and testing of all concrete for the plant. Pittsburgh Testing Laboratory field inspectors were qualified technicians with at least 5 years experience in concrete work. Pittsburgh Testing Laboratory performed the following services:

A. Provided an inspector at the concrete batch mixing plant who checked the quality of materials, accuracy of measuring equipment, and makeup of each batch of concrete.

B. Provided one or more inspectors at the construction site to make slump tests, make test cylinders, and monitor the handling and placement of the concrete.

17.1.3.6 Dames & Moore

This firm is nationally known as consultants in the field of earth sciences. They made the studies of site geology and seismology. Dames & Moore furnished qualified soils engineers to the plant site during excavation and backfilling operations to do the following:

A. Inspect and classify excavated materials according to their suitability for use for backfilling, road base, etc.

B. Review and approve proposed methods and procedures for excavation, especially blasting.

C. Inspect finished excavation, examine the undistributed soil and rock, and evaluate its suitability and competence to bear the loads required by the design.

D. Recommend measures for the protection of excavated areas of soil and rock until the concrete is to be poured.

17.1.3.7 Bechtel Corporation

As construction contractor, the Bechtel Corporation was responsible for the inspection and quality control operations described below:

A. Procure construction materials in accordance with specifications prepared by Gilbert Associates. They were to obtain from the suppliers certified test reports of physical and chemical properties and inspect materials as they were received at the plant site. No deviations from specifications were to be accepted without approval by the designer.

B. Perform all construction work in accordance with the plans and specifications and maintain an adequate force of qualified supervisory personnel at all times. No deviations from plans and specifications were to be made without approval by the designer.

C. Maintain, as a part of their field engineering group, an adequate force of qualified personnel, thoroughly familiar with the plans and specifications, who were to perform a thorough inspection of each construction operation of unusual conditions for review and permanent record.

Bechtel Corporation was fully responsible for the work of its subcontractors and monitored their inspection activity to ensure its adequacy.

17.2 QUALITY ASSURANCE DURING THE OPERATIONS PHASE

The quality assurance program for the operations phase of the R. E. Ginna Nuclear Power Plant described in Supplement IV to Technical Supplement Accompanying Application for a Full-Term Operating License, Docket No. 50-244. Supplement IV through Revision 8 was submitted to the Regional Administrator, NRC Region I, in accordance with 10 CFR 50.54(a) on June 6, 1983. The program was reviewed by the Region and the proposed changes were reported to be acceptable by NRC Region I letter dated August 10, 1983, "10 CFR 50.54 QA Program Description Change Review for R. E. Ginna Nuclear Power Plant." A common quality assurance program for the legacy Constellation Energy Nuclear Fleet was approved by the NRC on December 21, 2006. Ginna later came under the Exelon Generation Company, LLC, quality assurance program when the Ginna operating license was transferred (see Section 1.1 for details about the license transfer). Changes to the approved quality assurance program (Quality Assurance Program Topical Report (QATR)) are submitted to the NRC in accordance with the provisions of 10 CFR 50.54(a).