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QUALITY ASSURANCE CASE STUDY WORKING PAPER
CASE B

PART I

May 25, 1983

U. S. NUCLEAR REGULATORY COMMISSION
Washington, D. D. 20045

D R A F T

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QUALITY ASSURANCE CASE STUDY WORKING PAPER
FOR PLANT VOGTLE OF THE GEORGIA POWER COMPANY -
CASE B

This is one in a series of case studies performed in support of the Nuclear Regulatory Commission's emphasis on quality assurance initiatives.[1] Each case study is comprised of 1) a review of background information on the construction of the nuclear plant addressed by the Case Study, 2) interviews or presentations with NRC Regional Office personnel and Licensee personnel, and 3) interviews with Licensee and Licensee contractor personnel. This report is a compilation of data on background information, persons contacted, and plant characteristics.

I. Background Information

A. Utility Assessed

Georgia Power Company (GPC), Plant Vogtle located near Augusta, Georgia. Organizations involved in the construction of Plant Vogtle include the following:

Organization	Abbreviation
Bechtel Power Corporation	BPC
Chicago Bridge & Iron	CB&I
Cleveland Electrical Contractors	Cleveland
General Electric	GE
Georgia Power Company	GPC
Ingalls Iron Works	Ingalls
NISCO, Inc.	NISCO
Pullman Construction Industries/Kenith For[illegible]n Co., Inc.	PKF
Pullman Power Products	Pullman
Research Cottrel, Inc.	RCI
Southern Company	SC
Southern Company Services	SCS
United States Nuclear Regulatory Commission	USNRC
Walsh Construction Company	Walsh
Williams Contracting	Williams
Westinghouse Electric Corporation	Westinghouse

[1] Assurance of Quality, SECY-82-352, W. J. Dircks, August 20, 1982.

B. Dates/Places of Field Work

1. December 2 and 3, 1982 - discussions with NRC Region II staff and licensee senior management staff in Atlanta, Georgia.

2. December 6 through 10, 1982 - discussions and interviews with licensee's and contractors' staffs at Plant Vogtle site near Augusta, Georgia.

C. Case Study Team

Quality Assurance Operations and Training

W. D. Altman
Project Team Leader
NRC Headquarters

L. D. Kubicek
EG&G Idaho, Inc.

Project Management and Engineering

Harold Harty
Battelle Pacific
Northwest Laboratory

J. L. Heidenreich
N. C. Kist and Associates

Construction

H. J. Kirschenmann
EG&G Idaho, Inc.

M. G. Patrick
Battelle Columbus

D. Persons Contacted

1. On December 2 and 3, 1983, team members Willard Altman, NRC, and Miles Patrick, Battelle, visited the Georgia Power Company's corporate offices and NRC's Region II office in Atlanta, Georgia. Discussions were held with V. Brownlee, NRC Region II Section Chief for Plant Vogtle, and J. Lennehan, NRC Inspector. The following Georgia Power Company representatives were contacted:

   - J. H. Miller - President
   - R. J. Kelly - Executive Vice-president - Power Supply
   - R. E. Conway - Senior Vice-president - Engineering, Construction and Projects
   - D. E. Dutton - Vice-president - Generating Plant Projects
   - D. O. Foster - Vice-president and General Manager (Plant Vogtle)
   - P. D. Rice - General Manager QA and Radiation Safety and Health
   - C. Hayes - QA Manager - Plant Vogtle
   - O. Batum - Manager Project Engineering and Licensing - Plant Vogtle

M. Manry - Plant Manager - Plant Vogtle Operations

R. Staffa - Manager - QA

J. A. Bailey - Southern Company Services - Licensing Manager

E. Turner - Assistant to Plant Vogtle General Manager

2. On December 6, 1982, the entire team met with the following personnel for introductions and general briefing on the purpose of the site visit:

Nuclear Regulatory Commission

W. Sanders - NRC Resident Inspector

V. Brownlee - NRC Region II Office

Georgia Power Company

J. Boddie - Site Document Control Supervisor

J. Dorough - Manager Administration and Warehousing

W. Evans - Manager Mechanical Project Section

D. O. Foster - Vice-president and General Manager (Vogtle)

M. Googe - Assistant Project Manager - Construction

E. Groover - Site QA Supervisor

R. Kelly - Executive Vice-president - Power Supply

R. McManus - Manager QC

C. Miles - QA Field Supervisor

W. Rountree - Superintendent of Field Coordination

E. Turner - Assistant to Project General Manager

T. Weatherspoon - Assistant Manager QC

Bechtel Power Corporation

J. McLachlan - Site Manager

Cleveland Electrical Contractors

J. Blount - Site Manager

Pullman Products

T. Griffin - Site Manager

Ingalls Iron Works

N. Griffin - Site Manager

Research Cottrell, Inc.

R. Jones - Site Manager

NISCO, Inc.

H. Nixon - Site Manager

Williams Contracting

A. Bell - Site Manager

Others present for whom no organizational designations were obtained included:

D. Harris

J. Proud

R. Harbor

3. The Case Study Team was comprised of three two-person subteams: Quality Assurance Operations and Training; Project Management and Engineering; and Construction. Collectively these subteams interviewed about 50 persons during the week of December 6 to 10, 1982, as follows:

a. Quality Assurance Operations and Training

Nuclear Regulatory Commission

V. L. Brownlee - Region II Section Chief

W. F. Sanders - Senior Resident Inspector

Georgia Power Company

M. Bellamy - Power Generation Engineering Superintendent

J. L. Bishop - Concrete Inspector

J. L. Blocker - Civil Quality Control Section Supervisor

R. Cannady - Concrete Test Inspector

F. P. Castrichini - Manager, Cost/Schedule

J. O. Dorough - Assistant Construction Plant Manager, Administration

D. O. Foster - Vice-president/General Manager of Vogtle Plant

M. H. Googe - Assistant Construction Plant Manager, Field Operations

E. D. Groover - Site Quality Assurance Supervisor

L. E. Hatcher - Concrete/Soils Test Lab Supervisor

R. J. Kelly - Executive Vice-president, Power Supply

A. N. Lankford - "A" Shift Quality Control Supervisor

M. Manry - Plant Manager, Power Generation

W. McCord - Concrete Batch Plant Inspector

R. W. McManus - Manager, Quality Control

C. Miles - Quality Assurance Field Supervisor

D. C. Moncus - Field Coordinator

D. Moore - Document Review

J. Nevarex - Quality Control Inspector

D. R. Sikes - Field Coordinator

R. W. Staffa - Manager, Quality Assurance

H. Walker - Assistant Plant Manager, Operations

T. Warren - "B" Shift Inspection Supervisor

T. L. Weatherspoon - Assistant Manager, Quality Control

R. I. Wolfe - Document Review Supervisor

Walsh Construction Company

J. Johnson - Concrete Superintendent

(Contracted Testing Agency)

M. Lindsay - Concrete Test Inspector

b. Project Management and Engineering

Georgia Power Company

J. Boddie - Site Documentation Supervisor

J. Carroll - Civil Area Engineer

D. Cockerill - Labor Relations Coordinator

J. Dorough - Assistant Construction Project Manager

D. Foster - Plant Vogtle Project General Manager

M. Googe - Assistant Construction Project Manager

B. Harbin - Civil Project Supervisor

S. Jones - Documentation Clerk, Electrical

D. Ross - Civil Engineering Supervisor

K. Sethi - Quality Control Electrical Section Supervisor

J. Sipper - Electrical Project Section Supervisor

<u>Bechtel Power Corporation</u>

F. Castrichini - Manager, Cost/Schedule

J. Mamon - Quality Engineer

J. McLachlan - Project Engineer

c. <u>Construction</u>

<u>Georgia Power Company</u>

J. Beasley - Supervisor of Area Coordinators

D. Borowski - QC Supervisor, Electrical

W. Evans - Mechanical Project Section Supervisor

M. Googe - Assistant Construction Project Manager

R. May - Electrical Engineer

R. Osborne - Supervisor, QC, Mechanical

H. Richards - Construction Coordinator

W. Rountree - Superintendent of Field Coordination

D. Sikes - Supervisor in Construction Coordination

J. Stanley - Supervisor of Area Coordinators

T. Weatherspoon - Assistant Manager, QC

<u>Cleveland Electrical Contractors</u>

H. Miller - Welding Coordinator

P. Mills - Training

<u>Pullman Power Products</u>

T. Griffin - Site Manager

P. Runyon - Manager QA/QC

K. Weiss - Assistant General Superintendent

D. Winburn - Assistant General Superintendent

4. An exit interview meeting was held with the following personnel from the Georgia Power Company:

R. J. Kelly - Executive Vice-president, Power Supply

D. O. Foster - Vice-president and General Manager (Plant Vogtle)

E. Groover - Quality Assurance Site Supervisor

M. Googe - Assistant Construction Project Manager - Field Operations

J. Dorough - Assistant Construction Project Manager - Administration

F. P. Castrichini[1] - Manager, Cost/Schedule

T. L. Witherspoon - Assistant Manager, Quality Control

M. Manry - Plant Manager, Operations

R. W. Staffa - Manager, Quality Assurance

E. Bibliography of Material Reviewed in Conjunction with Plant Vogtle Assessment

1. Organization Charts

a. Vogtle Electric Generating Plant Power Generation Organization, November 28, 1982

b. Vogtle Electric Generating Plant Project Organization, November 27, 1982

c. Vogtle Electric Generating Plant Engineering and Licensing Organization, November 27, 1982

d. Vogtle Electric Generating Plant Construction Project Organization, November 27, 1982

e. Southern Company General Organization, November 24, 1982

f. GPC General Organization, November 24, 1982

g. GPC Power Supply Organization, November 24, 1982

h. GPC Power Supply Engineering, Construction, and Major Projects, July 1, 1982

i. GPC Generating Plant Major Projects, July 1, 1982

j. GPC Power Supply Organization, July 1, 1982

k. Vogtle Electric Generating Plant Project Quality Assurance Organization

l. Other Organization charts

(1) Construction Project Manager's II Organization

(2) Quality Control Manager's Organization

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(1) Bechtel Power Corporation employee

(3) Assistant Construction Program Manager's (Googe) Organization

(4) Assistant Construction Program Manager's (Dorougn) Organization

(5) Vogtle Electr.c Generating Plant Licensing Organization

2. Excerpts from "Moody's Public Utility Manual," pages 3373-3380 on Southern Company.

3. Excerpts from "Electric World," Directory of Electric Utilities, 1981-1982, 90th Edition, pages 151-154.

4. GPC Quality Assurance Procedures

   a. QA-01-01, "Organization and Responsibilities of the QA Department," Rev. 8 (5/82)

   b. QA-01-02, "Job Functions and Responsibilities/Manager of Quality Assurance," Rev. 4 (1/81)

   c. QA-01-05, "Job Functions and Responsibilities/QA Site Supervisor," Rev. 5 (10/80)

   d. QA-01-14, "Job Functions and Responsibilities of the PQAM," Rev. 2 (3/79)

   e. QA-02-02, "Timely Reporting to the NRC," Rev. 2 (11/81)

   f. QA-03-02, "Training and Personnel Qualification," Rev. 7 (5/82)

   g. QA-04-02, "Significant Deficiency/Defect Reporting - 10CFR55(e)/10CFR21," Rev. 5 (5/81)

   h. QA-04-04, "Proposal-Requisition Review/Approval," Rev. 4 (5/82)

   i. QA-04-15, "QA Filing," Rev. 3 (1/81)

   j. QA-05-01, "Corporate Staff Audits," Rev. 4 (6/81)

   k. QA-05-02, "Site Audit (PQAM)," Rev. 5 (5/79)

   l. QA-05-03, "Supplier Audit/Inspection," Rev. 3 (1/81)

   m. QA-05-04, "Audit/10CFR50, Appendix B Verification," Rev. 2 (4/78)

   n. QA-05-13, "Open Items Control," Rev. 7 (5/82)

o. QA-05-14, "Field Audit," Rev. 2 (12/80)

p. QA-05-16, "Stop Work Orders," Rev. 0 (4/79)

5. Related Correspondence

a. Georgia Power Company Inspection Report 72-1, Introductory Corporate Management and Initial Quality Assurance Meetings, on March 6, 1972

b. GPC, Alvin W. Vogtle Nuclear Plant, Units 1 and 2, Inspection Reports 50-424/78-6 and 50-425/78-6, on August 28-29, 1978

c. GPC Inspection Report 50-424/79-14 and 50-425/79-14, on August 21-24, 1979

d. GPC Inspection Report 50-424/80-03 and 50-425/80-03, on February 5-8, 1980

e. GPC Inspection Report 50-424/81-02 and 50-425/81-02, on January 6-9, 1981

f. GPC Inspection Report 50-424/81-05 and 50-425/81-05, on April 20-22, 1981

g. GPC Inspection Report 50-424/82-18 and 50-425/82-18, on June 11 to July 10, 1982

II. Description of Plant

Georgia Power Company's Plant, Alvin W. Vogtle, is currently under construction (about 36 percent complete) on the Savannah River about 35 miles from Augusta, Georgia. Vogtle is a dual reactor plant (two Westinghouse PWRs) each having a design capacity of 1160 MW electrical. Unit 1 is about 42 percent complete; Unit 2 about 14 percent. Engineering work was started in December 1971 and the Construction Permit was issued by NRC in June 1974. The utility suspended construction activity in September 1974, apparently for economic reasons. The project was reactivated in July 1976 and the first permanent concrete was placed in August 1978. The original planning for the project included the installation of four reactors. However, this was changed in 1974 to the current plans for two units.

Commercial operation is scheduled for March 1987 (Unit 1) and September 1988 (Unit 2).

The Georgia Power Company is one of five subsidiaries of the Southern Company. The others are: Alabama Power Company, Mississippi Power Company,

Gulf Power Company, and Southern Company Services. Engineering licensing and cost/schedule support for Plant Vogtle is provided by Southern Company Services.

The A-E for design of Plant Vogtle is Bechtel which has subcontracted the NSSS design to Westinghouse. Other major contractors include:

Westinghouse - NSSS supplier
General Electric - Turbine-generator sets
NISCO, Inc. - NSSS installation
Walsh Construction Company - civil
Cleveland Electrical Contractors - electrical
Pullman Power Products - mechanical (piping)
Pullman Construction Industries/Kenith Fortson Company - HVAC
Ingalls Iron Works - rigging and non-Q steel
Research Cottrell, Inc. - cooling towers
Fundamental Materials, Inc. - concrete
Chicago Bridge and Iron - containment liner and selected vessels
Williams Contracting - coatings

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MAY 25, 1983

NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC. 20555

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I. SUMMARY

A. Introduction

The Nuclear Regulatory Commission (NRC) has undertaken a study of selected nuclear reactor construction projects to determine the important factors or root causes that underlie effective and ineffective assurance-of-quality programs. Several nuclear projects which have experienced major quality-related problems and several which have not will comprise the study population. This collection of site-specific case studies will be used by the NRC in the formulation of generic policies and programs related to quality assurance, and in responding to the Congress (Ford Amendment to the 1982-83 NRC Authorization). This Report summarizes the findings from the second Case Study.

B. Background

The Licensee of Case B has one nuclear station in operation and a second one under construction, both consisting of two large units (approximately 1,000 megawatts each). The former station has been in operation since the mid-1970s. The latter station is approximately half completed. Its construction permits (CPs) were issued in the mid-1970s. Licensee fiscal problems required an approximate 18-month slowdown in the construction of the station, so commercial operation is not anticipated until the latter half of the decade. Construction is presently proceeding on a round-the-clock, 7-day per week basis.

The Licensee is the construction manager for the project. The major construction contractors -- civil, mechanical, and electrical -- all have had significant nuclear plant construction experience, as have many of the smaller contractors.

The architect-engineer for the Case B nuclear station has had extensive experience in the design and construction of nuclear power plants. Some of the non-safety-related design is being done by the engineering staff of the Licensee's holding company.

The Licensee has experienced no major quality problems to date in the construction of this nuclear station (and, as far as the Case Study Team knows, none occurred in the construction of the first station, either). There have been minor quality problems in the areas of engineering and construction, but the Licensee has taken positive action to correct them. There has not been significant public intervention in the licensing or construction phases of the Case B nuclear station. No significant fines have been levied against the Licensee for nonconformance violations or quality deficiencies.

The assessment team for the Case B study[1] was comprised of three teams of two personnel each; one concentrating on the project engineering/design aspects, one on construction, and one on quality assurance programs. Prior to the plant visit, two of the personnel spent one day at the Licensee's headquarters reviewing the project with the Licensee's upper management, and one day with the NRC regional staff. The entire team spent five days at the plant site. There were several group interviews and discussions with the Licensee's senior project management. Altogether, about 50 interviews were held at the plant site with individuals intimately involved with the project. In addition to the interviews and discussions, the entire assessment team spent one-half day touring the construction site. The site assessment culminated in a briefing for company officers and project staff members in which the findings of the team were reviewed and the Licensee staff had an opportunity to comment on the team findings. Neither the AE home office staff nor the holding company's engineering staff was visited.

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[1] The Methodology for the Case Studies is described in "Long-Term Quality Assurance Review: Site Assessment Methodology," November 8, 1982 (Draft).

C. Summary of Findings

The objective of this Case Study was to determine what were the root causes or important factors which contributed to the absence of significant quality problems at the Licensee's nuclear construction project. The team identified the following factors:

1. The Licensee has an experienced design, construction, and construction management team. The Licensee has had prior experience with a previous nuclear station, and many of the personnel who worked on it are now involved in the present project. This experience has given them an understanding and appreciation of the complexity of large nuclear station construction activities. Many of the staff have 5-10 years experience in nuclear work. The persons contacted, in general, had good qualifications for their assignments. There is a substantial training program and an overall impression of a high level of dedication and enthusiasm to the job. Early in the construction process, it was recognized that craft personnel needed further training on the special requirements of nuclear work, and this resulted in a comprehensive blue-collar training program. The QA/QC staff is broad and deep in experience and qualifications.

2. The Licensee has an orientation toward, and an attitude supportive of, quality in their nuclear project. The stated management philosophy of insisting on quality was not simply to satisfy the Nuclear Regulatory Commission (NRC) but to go beyond those requirements to have a reliable and safe operating plant. At higher levels in the management structure, the conviction appeared to prevail that public safety and company profitability demand quality in the construction (and operation) of nuclear plants, and that it is less expensive in the long run to "do the job right the first time." From the interviews conducted, both at

the corporate offices and the site, it was evident that a sense of commitment to quality pervades the Licensee's organization at all levels. The Licensee volunteered for the first INPO construction audit and has expanded on it with their own self-initiated evaluation. The quality assurance/quality control (QA/QC) staff has direct access to an executive vice president. There was no indication from the interviews of cost/schedule overriding QA/QC. At lower levels, there was an expressed feeling that the company wants to do the job right. Employees at all levels appeared to have a constructive attitude toward the need for quality in general, and quality assurance, in specific. A pro-company attitude and good morale on the part of the employees appears to exist.

The architect-engineer has designed (and constructed) many nuclear power stations.

The major construction contractors (especially the mechanical and electrical contractors) and the smaller contractors have had previous experience in the construction of nuclear projects.

3. The Licensee manages the project, and it has clearly defined the responsibilities and authorities of the participants, and has provided adequate procedures to ensure compliance, especially at the interfaces. This is manifest most clearly in day-to-day activities at the site. The Licensee is running the job. The Licensee does not rely on the major contractors to perform overall management functions. It is also manifest by the fact that the direction for the overall quality assurance program comes from the Licensee and not from its subcontractors. There are limited and defined points of contact through which the Licensee directs the work of its contractors. Personnel within the Licensee's and the major subcontractors' staffs were knowledgeable of their own, as well as others', responsibilities and authorities. (This, despite the fact that the organizational structure is quite complicated and not easily understood at first review; however, within the plant project team, the organizational structure is straightforward).

Large geographical separation of some of the major organizations from the site (e.g., the AE and the mechanical and NSSS contractors' home offices, in particular) was seen to hamper communications.

4. The Licensee supports its assurance-of-quality program with adequate resources and backing. This is manifest at the top of the Licensee's organization by a project management board comprised of senior utility management, senior project management, and senior AE and NSSS representatives reviewing the project, examining problems, and maintaining cognizance of nuclear matters. Quality does not seem to be sacrificed for the schedule and cost considerations (the Case Study Team did not have occasion to evaluate schedule and cost pressures, however). The Licensee and contractors have good training programs for crafts and quality control personnel. The planning, scheduling, and budgeting activities appear to allow for adequate resources to do the job properly. Work was observed to be on schedule and chronic delays were not evident. Procedure compliances were stressed at all levels and daily work schedules appear realistic enough to allow work to be completed in accordance with those procedures.

   The Licensee is proactive in looking for improvement in its assurance-of-quality practices. Key managers were on a retreat to consider new approaches to the assurance-of-quality problem. This Licensee was the first to be evaluated under 10CFR50 Appendix B. Their own QA organization was asked by top management to study the QA programs of other licensees as early as 1978. They have been involved in one of the pilot studies for the INPO audits. They have also participated in self-initiated evaluations. There were numerous comments and indications in the interviews that problems, deficiencies, and areas of improvement can be surfaced without punitive actions.

5. The Licensee's QA/QC function is active in reviewing, witnessing, and verifying contractors' work. A well-staffed program with good procedures exists to insure that construction conforms to the design. Licensee construction coordinators, many of whom have been quality control inspectors, do a preinspection of craft work prior to formal inspection by QC. There is feedback of lessons learned from earlier construction experience and from other projects. The Licensee and its contractors have an effective corrective action program which brings about needed change. Design reviews by the Licensee for constructability and operability were thorough.

   The project engineering staff reviews the design primarily for constructability. This appears to be the major design review (no data were obtained on the independent design reviews within the AE organization), though some design review may occur at the corporate offices.

The foregoing factors are discussed in greater detail in the following section.

There were several observations which the Assessment Team made which could improve the Licensee's assurance of quality in the design/construction process. These included:

1. Document control: destruction of obsolete specifications and drawings is not tightly controlled. Current practice could allow use of uncontrolled or superseded drawings.

2. Procurement procedures: the receipt inspection, source inspection, and communication to vendor of specification requirements should be strengthened.

3. Construction process control: while the pour-card approach for civil-structural work and the application of process data sheets for the mechanical contractor are good, some of the other contractors, including the electrical contractor, lack procedures which could allow necessary inspections to be missed.

4. Field change requests and nonconformance requests: during the period of October 1 to November 17, 1982, there were 1389 field change requests and 463 nonconformance requests processed. This continues at the rate of about 30-50 per day. This could be the result of some deficiency in the design process. (The AE design function is being audited on this item).

5. Senior management involvement at the site: Licensee senior management should take a more proactive role in personally communicating the importance of quality to its staff at the construction site.

6. Formalized quality engineering capability: at the present time, there is no formal quality engineering function in the Licensee's project staff. This function would help ensure that the process of translating the design into construction was carried out efficiently.

7. Trend'ng of QA/QC findings: a better presentation of the results of QA/QC activities to management would enhance the assurance-of-quality program. The system in use now only identifies problems generally, and not specifically enough to identify to management what kinds of actions need to be taken. (It was noted that the Licensee had initiated work on improved procedures).

This Case Study is the first one in which the Licensee's project had not previously experienced major quality problems. Thus, there could be no comparison with other plants without major quality problems. The Case Study Team's evaluation of 20 generic indicators of quality is in Appendix A.

II. ROOT CAUSES OF THE LICENSEE'S SUCCESS WITH QUALITY IN CONSTRUCTION

Based on the Case Study Team's review with the Nuclear Regulatory Commission Regional Office, documentation pertaining to the Licensee's project, and discussions and/or interviews with about 50 Licensee and contractor staff personnel, the Team believes that the root[1] causes of the Licensee's success with the quality of construction reside in the following factors:

A. The Licensee has an experienced design, construction, and construction management team. As previously stated, the Licensee has constructed a previous two-unit nuclear power station that went into commercial operation in the mid-1970s. The AE has been involved in nuclear power plant design and construction for over 20 years, and has been the AE and/or construction manager on many nuclear plants. The electrical and mechanical contractors participated in the construction of the Licensee's previous plant, as well as other nuclear plants.

The experience levels of the Licensee's staff and contractor managers varied considerably. Many of those in key positions with the Licensee have less experience than one might expect to find in similar projects; however, many of them have been with the Licensee for 5-10 years and have worked at the Licensee's previous nuclear station before going to the Case B station. It is apparent that the previous nuclear plant provided both the Licensee and many of its personnel with valuable nuclear plant experience. This experience has resulted in, or permitted, a matrix organization which includes personnel in key positions from the Licensee's holding company engineering function, the AE, and the NSSS vendor.

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[1] See Appendix B for definition of root causes.

One result of the experience by the Licensee is the creation of the Project Management Board. As previously stated, it is comprised of corporate level executives from several companies which play an active role in the project and is chaired by the Licensee Chief Executive Officer. It meets monthly, and several of the Licensee's management cadre emphasized good attendance of board members at these meetings and their active participation in them. The Project Management Board is viewed essentially as a separate board of directors relative to the Case B Project. The Board is obviously composed of those who can make major decisions and commitments for their respective organizations. Further, it provides a forum for executive level communications between key organizations. (It must be observed, however, that in a meeting attended by a portion of the Case Study Team and which included five Licensee vice presidents and the company president, the latter did all of the talking).

As previously stated, the major work force of the AE is located off site, and the problems related to this situation are being reviewed. The on-site engineering function is comprised of about 35 AE employees and about 10 Licensee employees. In the past, original drawings were not made at the site. This may change, however, because of the need for closer coordination between construction and engineering. To improve engineering response time, one action being taken is to move an NSSS team on site in early 1983. This will result in 21 additional people being added to site engineering principally in connection with the installation of small bore piping.

Since the Licensee and many of its construction contractors have had prior nuclear power plant experience, the effect of applying lessons learned is very beneficial to the construction program. For example, operations involvement in construction activities is more detailed and earlier than for the Licensee's previous station. Also, some operations engineers have been assigned to construction engineering to enable them to better understand the plant. Quality problem items are included on the agenda of major management meetings. Management encourages getting problems on the table so that they can be dealt with. Employees seemed to recognize that management appreciates that problems will occur and that the important thing is to prevent recurrence. One case that was occurring at the time of the site visit related to protection of erected equipment. It was refreshing to hear a supervisor take the responsibility for the deficiency without blaming others. This attitude exists not only within the Licensee's structure, but also in the interface with the NRC inspection personnel. This openness without fear of recrimination tends to get problems solved before they become unmanageable.

Another experience factor is that all field (construction) coordinators are trained in the inspection techniques and approximately half of the coordinators are ex-inspectors. The crafts are therefore provided with an interface which emphasizes quality requirements consistent with that of the Licensee's inspectors.

The QA/QC staff was noted to be broad and deep in its qualifications. When hired, these qualifications are further developed through formal classroom and on-the-job-training. The recruitment for QA people stresses degreed personnel with experience in the practical side of the nuclear industry. Experience for QA management personnel ranged from 20-30 years; the average QA staff had approximately 10 years experience. The QC inspection supervisors have typically two and four-year technical degrees and the section supervisors have a bachelor's degree as minimum education. Their experience ranges from 12-30 years.

The Licensee uses an unusual construction shift work arrangement. The project is manned nearly 24 hours a day, 7 days a week, with four non-rotating shifts. There are problems with conflicts between shifts, but the Licensee considers the benefits worth the additional problems. For instance, more workers can be utilized to improve the schedule. The current total job site work force is about 7700 employees. Somewhat better than average site ambient temperature conditions exist for concrete placement. In cooler weather, most of the concrete is placed on day shift. A larger pool of skilled crafts is available. This is true in part because two of the shifts work only 3-day weeks and thus can use the other four days for commuting longer distances.

The union contracts also manifest experience of the Licensee; e.g., each shift is paid straight hourly time for a specific number of hours in lieu of conventional overtime; there are no formal scheduled coffee breaks; in the event of a walkout by one craft, there is no picketing, hence, other crafts continue to work. The Licensee uses selective bid lists for on-site contractors; however, open shop contractors are permissible providing they abide by the special Licensee-union agreements. The Licensee takes an active part in negotiations between the union and the construction contractors.

B. <u>The Licensee has an orientation toward, and an attitude supportive of, quality</u>. The executive levels of the Licensee evidenced a very good understanding of the significance and ramifications of building and operating nuclear generating stations. This is probably due, in large part, to their experience with a previous station, which came in line in the mid-1970s. There was no indication of a "fossil mentality" at the executive level. (This term refers to a utility's attitude that, since it was successful in building fossil fuel plants, it could be successful in building nuclear plants using the same techniques, personnel, and effort). While the Licensee's management seems very much aware of the importance of complying with NRC requriements, the comment was made, "satisfy the NRC and everything is okay, is not true; you have to satisfy yourself." There was recognition that a utility can be at considerable financial risk with a nuclear plant.

There was considerable evidence of a top management commitment to quality. Further, there were indications of activities to directly address bringing about improvement. Some of the comments that indicate this were:

- "There is a lot of talk about quality in nuclear construction. Some think there is a need for more of the same thing that isn't working. We don't want just more of the same -- what can we do that is innovative."

- "Maybe the industry and NRC need to back off and look. Maybe QA wasn't put in place right the first time."

- "Are we looking to see if we are doing what we said we would do, or what is right."

- "We are going to look at how we look at the QA organization and the growth potential for the people in it, also QC." [1]

An example of management's concern with quality, and its attempt to be aware of impending problems is the creation of a Project Management Board. This Project Management Board meets monthly and it consists of the Chairman of the Board (of the Licensee), the presidents of two of its operating components, the executive vice presidents of finance and construction, the vice president of the architect-engineer firm, and a member of the NSSS firm. This Board gives the Project General Manager direct access to top level management of engineering, construction, and startup. The Board deals with costs, schedules, and quality assurance. A typical meeting includes mostly input from the project staff, but there is also some direction given to the project staff. Two examples of items recently discussed related to secondary water chemistry and seismic problems. The Project General Manager said this high level management involvement in significant problems was very helpful.

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[1] Quotations are not verbatim, but they are believed to convey the meaning intended.

The Project General Manager acknolwedged that it is very difficult to get the crafts to take on the same attitude toward quality as top management has. If for no other reason, it is important to do so because upwards of $1-2 million per day is being spent on the project, and rework due to inadequate quality only escalates the costs and delays completion.

The Project General Manager had been involved in the Licensee's earlier nuclear station. He commented on changes which have occurred between the earlier nuclear station and the present one: the power generating division (i.e., the operations staff) has been integrated into the construction effort; a simulator has been built adjacent to the site; the project has been organized to do as much work at the site as possible; improved facilities (e.g., warehouses and offices) have been built at the site; all engineering capability needed for the project including subcontractors report within the engineering organization; the quality assurance organization structure has been put in a stronger position; personnel with greater experience in quality assurance have been hired; there have been significant management changes for the better; there is now a positive attitude toward quality, and (though he acknowledged that there was a negative attitude to the processes required to support quality; i.e., paperwork and filling out forms), he expressed concern about the communications problems which continue to arise because of the distance/time zone situation with regard to the AE and NSSS home offices and the construction site. This may be related to the large number of design change notices which have occurred.

The Project General Manager noted in his closing remarks that the Licensee does not penalize employees when problems arise. This policy, he said, encourages the surfacing of problems at an early time.

The Licensee's attitude toward quality was also expressed by the Assistant Construction Project Manager. When asked what he perceives as management's commitment to quality, he enumerated several things:

First, personnel with greater quality assurance experience have been hired. Second, management keeps abreast of the work in the quality assurance department. Third, management has endorsed the INPO self-initiated evaluations. Fourth, management reviews quality assurance findings. He said that an executive vice president periodically checks on his work, and he perceives, as does his staff, that the Chief Executive Officer is interested in quality assurance. He said that when there are accountability reviews at the top of the organization, they are interested first in safety, second in quality, and then in cost and schedule.

In response to a question concerning what quality assurance changes he has seen in the last three years, the Assistant Construction Project Manager said that there is an increased awareness of quality assurance and that the training programs (especially in the civil area) were emphasized. He perceived that craft personnel are more knowledgeable of quality assurance, and this has helped in communication with them, and has increased productivity. The independence of the quality assurance organization is another major change. The attitude towards quality assurance is now one of increased openness. A vice president directly responsible for project QA now has direct access to the Chief Executive Officer. He said the construction forces and the project management are now working together better on quality matters. The supervisor of the civil projects section said that the message from management is stay on schedule, but hold quality. (But then in a subsequent statement, changed and said that if something has to suffer, it should be schedule, not quality). The Licensee only wants to do the job once. Effort then would be applied to improve the schedule later. When asked the question why no major QA deficiencies had occurred at the Licensee's site, he said that the project is a whole team effort. They have a feeling that this job has to be done right and that the engineers, coordinators, QA/QC people, and contractors work together. They have the attitude that this job will be Number One.

The Manager of Quality Assurance and the quality assurance field supervisor said that they do not win all their battles when they approach senior management and try to bring about change. They feel, in some cases, they have not done the best salesmanship job they could have. In other cases, though, where it really counted, they made their case heard and had gotten appropriate action. They stated that top management's door has never closed to the quality assurance organization. It is readily accepted and backed by other management, too.

The Licensee has used stop work order authority approximately six times to shut down a contractor's operation completely. Contractors' operations have been shut down because of coating problems, cadwelding, concrete work, and for housekeeping. Individual jobs are stopped routinely. The situation now exists where most construction will stop their own work at the first level of quality control when problems arise. When a contractor's entire operation is stopped, the order originates about half the time with the quality control groups and half the time with engineering.

The same general attitude toward quality was forthcoming from a concrete inspector. He said, "I don't have to go upstairs to get backing when I call the question on something. We (QC) can pretty much handle day-to-day problems without having to resort to escalation; however, when something is escalated, it is usually something beyond my jurisdiction or authority." In the same interview, the statement was made that the Licensee was not afraid to fire people for poor performance.

Management's interest in the QA program is also demonstrated in the orientation and training program for crafts. Craft indoctrination includes a videotape entitled, "QA is Everybody's Business." The videotape includes a message from the Chief Executive Officer of the Licensee's holding company and other Licensee management stressing the importance of QA and the results of poor workmanship. Additionally, training including specification and workmanship requirements and rules of conduct specific to each craft is accomplished. For example, welders receive approximately 15 hours training, and electricians ten hours.

C. The Licensee manages the Project, and it has clearly defined the responsibilities and authorities of the participants, and has provided adequate procedures to ensure compliance, especially at the interfaces. The clearly defined responsibilities and authorities, together with appropriate procedures, stem from the Licensee's active management of the project. The extent of control exercised at the construction site is impressive. The cost-reimbursable contracts which the Licensee has with most of its contractors permit a large degree of control over day-to-day activities and the associated quality considerations. All materials and equipment used at the site are provided by the Licensee. The Licensee controls the staffing levels of all except two fixed-price contractors whose work does not significantly interface with other contractors. As previously stated, the project organization is a matrix-type organization and includes personnel in key positions from the Licensee's holding company engineering function, the AE, and the NSSS supplier. While the Licensee has not been as intimately involved in the AE's activities, it does review all drawings for constructability and operation. The Licensee is becoming involved in AE design audit through the INPO process and the self-initiated evaluation.

Advanced planning and scheduling, combined with management involvement, has resulted in the work being on schedule. Near-term work schedules are developed in concert with the construction contractors, but are controlled by the Licensee. These include daily, weekly, six-week, and three-month plans. Longer term scheduling and budgeting is done by the Licensee. Standard leadtimes are 11 months for materials, seven months for pipe, and 90 days for having all other materials, including consumables, ready for construction. The Project General Manager reported that the project is on budget for the year and about two months ahead of schedule (rebaselined in September 1981); however, the progress curve has flattened somewhat in the last two months. He said that contributing factors to maintaining schedule have been lessons learned from their previous nuclear station, better training of personnel, and better support facilities on the site.

The organizational structure in effect at the Licensee's plant is best described as complex. The interplay of different lines of direction, reporting, administration, and communications between the three major organizations involved; namely, the Licensee, the Licensee's holding company's engineering function, and the architect-engineer, as well as the entwined project relationships, make it difficult for one to understand the organization and its functions without considerable study. Nonetheless, the organization seems to work fairly effectively.

The Project General Manager, the highest ranking individual totally dedicated to the project, is a Licensee Vice President, but is at the fifth level below the President. Reporting to the Project General Manager is the on-site manager, called the Construction Project Manager. He is considered by the corporate office to be responsible for everything at the site. The on-site field or project engineering functions report to him as does the superintendent of field coordination. The latter views his function as the intermediary between engineering and field construction; however, at least one construction contractor views his official contact with the Licensee as the project engineering section supervisor, and the field coordinators as expediters for materials and tools, plus an arbitrator in relations with other contractors. The construction contractor's view was felt to be more accurate.

The QA and QC components are totally separated from each other and, for the Licensee, this seems to work well. The QC function reports to the Construction Project Manager.

The contracting and procurement function is managed from the Licensee's home office. In addition to the minimal use of firm fixed price construction contracts, another significant practice is that the Licensee provides all materials and equipment at the site. As a couple of interviewees expressed it, "All the construction contractors bring to the site is their bodies and their expertise."

Source inspection in vendors' plants is provided through project engineering by the architect-engineer and/or the Licensee's holding company engineering function. Receiving inspection at the site is provided by the Licensee's QC organization.

The Licensee's Quality Assurance Department is organized into a general office staff and a plant site staff. There are approximately 30 people who are directly involved with the programmatic side of quality assurance at the plant site. This is exclusive of the quality control personnel which, as previously stated, report separately from the quality assurance organization through the project side. Other quality control groups exist in the major subcontractor organizations. The mechanical contractor has about 70 inspectors. The NSSS supplier is presently staffing its site inspection forces. The general office staff of the Licensee's quality assurance is headed by project coordinating engineers and project quality assurance managers who report to the Manager of Quality Assurance and to the applicable project general manager for project direction. The Manager

of Quality Assurance staff assists in establishing quality assurance policy, interpreting NRC and government regulations, and in personnel and organizational planning. The project quality assurance managers are assigned to specific nuclear construction projects and are responsible for assessing implementation of quality assurance department directives as they apply to all aspects of design, construction, and operational testing.

Quality assurance staffs at the site are headed by a quality assurance field supervisor who reports to the Manager of Quality Assurance. He assesses all quality assurance activities at the construction site and reports results to project managment. The staffs are composed of quality assurance engineers or quality assurance field representatives for each engineering discipline involved in the construction activity, plus two or more qualified quality assurance engineers or field representatives for each operating unit. The prime job of the staff is that of audit. The personnel are responsible for assuring that plant site activities are accomplished in full compliance with the quality assurance manual, technical specifications, and procedural requirements.

The quality assurance program for the AE was not evaluated, as their work is primarily conducted at their home office.

With respect to the design process, the Licensee receives all drawings from the architect-engineer and, for non-safety related matters, from the Licensee's holding company engineering function. The project section supervisors review the activity packages and initiate field change requests and field change notices as they review the design for constructability. The Licensee does not do any design on safety-related systems or equipment. The on-site design functions of the architect-engineer are limited to nine items as far as design changes are concerned, such as cable tray supports and reinforcing rod matters. Construction will only work to AE-approved drawings. Each construction group within the Licensee's project controls its own drawings and each is audited by document control every three months for properly approved drawings. The mechanical contractor does the drafting work at the project site.

The architect-engineer's field office approves field change requests, nonconformance requests, and handles all drawings to the job site. Drawings are returned to the home office for revision. Field change requests are processed by the field office unless there is not adequate expertise at the job site. The design work is completed within the requirements of the project reference manual and appropriate regulatory guides. One of the architect-engineer's responsibilities at the job site includes maintaining an ASME Code Certification. The AE has the responsibility to perform design activities in accordance wich the ASME Code, Section III.

In summary of the foregoing, the Licensee has overall responsibility for the project. Its AE has overall plant architect-engineer responsibilities. Its NSSS supplier is responsible for NSSS design, and the holding company's engineering function has design of certain ancillary facilities.

D. The Licensee supports its assurance-of-quality program with adequate resources and backing. A number of items that lend credibility to this root cause for the success of quality in construction have already been discussed, including previous experience with nuclear station construction and use of experienced personnel.

The Licensee's management recognizes that QA boils down to an economic issue -- and a long-term one at that. They are not focused exclusively on the short-term goal of getting the station licensed, but on building a nuclear station that will operate safely for its expected life, and in a way to minimize costs over the entire life of the plant.

The AE on-site manager says he receives strong signals from both the Licensee as well as his own management with respect to quality. He said that the Licensee's management is very supportive of their quality assurance staff. He mentioned a problem with welds on piping spools fabricated at the mechanical contractor's home plant. There were only slight defects in the welds (i.e., some minor weld slag and pinholes). These were all repaired even though they were detrimental to the progress of construction. The AE's on-site manager was impressed.

The comment was made by the AE on-site manager that, wheras on other projects redlining drawings (to denote field changes) is accepted practice, for the Licensee's plant it is necessary to revise drawings.

The AE on-site manager, in responding to the question why no quality problems of a major nature have been experienced at the Licensee site, said that the Licensee's concerns about quality assurance and safety have been very high. They have spent much and they want to license the plant as efficiently as possible and to create a positive climate with respect to quality. He said the message is that nothing is to be sacrificed for schedule.

The Manager of Scheduling and Budget, an AE employee, said he was impressed with the Licensee's interest in quality as manifest by the Project Management Review Board feedback. He said the Executive Vice President reviews his program area about six times a year, devoting one day each time. He said the performance review for Licensee employees is now tied to budget and schedule. (Interestingly, most Licensee employees said that safety and/or quality were the first items in their performance reviews). Another quality input from management relates to the Project General Manager's review.

The importance and the extent of training programs has already been discussed to some extent. The various programs include the Licensee's QA training, construction craft training, and plant operations training. All of the QC inspectors of the Licensee have received at least one week of formal training conducted on site and off site. The Superintendent of Field Coordination has also required his entire staff to attend QC training programs.

Craft training programs are conducted by the construction contractors. In addition to a half-day orientation, the training programs have included specific classes in concrete placement and vibration, pipe weld preparation, grinding, cadwelding, electrical specification requirements, and storage and handling of materials.

The plant operations staff training program was impressive. The Licensee has installed a complete control room simulator at the site and trains station engineering staff as well as the control room operators on this simulator. Also, the Licensee has established agreements with other utilities so that some Licensee staff are assigned to operating nuclear power plants for a period of 12-18 months.

Attitudes are also important to the assurance of quality. There is active company involvement in looking for ways to do things better. The Licensee sends their employees to other utilities to gather different experiences and ideas, as well as studying comments and criticisms from other organizaitons such as NRC, INPO, and the holding company engineering function. The study on adopting an expanded role for quality engineering, establishment of senior management quality committee, organization of the People Achieving Excellence Program, giving QA more authority than it had in previous times, and adoption of the innovative concrete processes (e.g., plexiglass forms to prevent segregation) are examples of such progressiveness.

Sufficient resources as far as manpower, funds, and time have been allotted to provide adequate confidence that a quality performance will result. For instance, in interviewing the Assistant Manager for Quality Control, the question was asked how he knows whether he has sufficient manpower to do the work required. He described how he determined his manpower needs (they relate to construction team size) and he said that sometimes double shifts are required; however, he lets management know of his needs and they are usually filled.

The QA Manager has organizational independence and reports to an executive vice president. There is also a Senior Management Quality Assurance Committee made up of vice presidents from organizations such as engineering, construction, power generation, licensing design, and quality assurance, and these represent both the Licensee and the Licensee holding company's engineering function. It is headed by an executive vice president and provides a forum where significant schedule, money, and organizational quality assurance issues are settled.

The pro-quality attitude of senior management prevails throughout the Licensee's organization, and carries over into the contractors' operations. All individuals surveyed were able to talk intelligently on QA/QC as related to their sphere of work, although at some of the lowest levels (craft level) personnel had difficulty explaining why it was important. They just know it was because of the observed actions and the emphasis by management.

In summary, every project experiences the conflicting demands of quality, cost, and schedule. This one is no different, and the occasional ambivalence expressed by those interviewed shows the struggle. Overall, a good balance appears to be maintained.

E. The Licensee is taking a proactive role in looking for improvements in its assurance-of-quality program. A number of examples have been cited already, including the Project Management Board and the staff retreat to consider new approaches to quality. The Project General Manager's response to the question about changes which have occurred between the Licensee's first nuclear station and the present one (described more completely in Item B above) included the statements that:

1. The quality assurance organization for the constructor has been put in a stronger position and is headed by personnel who have extensive nuclear experience.

2. There has been a significant changeover in management, with a net result that there is now a more positive attitude toward quality.

In the day-to-day construction activities, the planning and coordination of project QA/QC interfaces is well done and conducive to good quality. The QC shifts overlap at shift change and interface with the construction coordination group in work planning and scheduling for the following shift. QC/contractor differences of opinion are quickly resolved.

The quality assurance program is actively managed by the Licensee. The organization structure for the project has the site QA overviewing the site QC, who overviews the contractors. Corporate QA overviews the entire QA program, as well as site QA. The Licensee's holding company's engineering function overviews all of its utilities' subsidiaries. The Licensee has not relied upon its contractors to provide program direction.

The requirements are spelled out in a well-documented program and are enforced through stop work orders that are both job specific and generic to a contractor. There has been early recognition of situations which may have developed into severe problems, such as an erosion problem (described in the following section). Cost-plus contracts are used nearly exclusively because of recognition that fixed-price type have often eventually forced poor quality. A shortage of trained work force, both in the professional and craft areas, is met by active recruiting and through implementation of an effective training program. Preparations for the operating phase are currently underway in addressing and resolving technical and programmatic issues. A nuclear training center for technical and maintenance activities is being built and future plant operators are now being trained in plant and on the reactor simulator.

The Licensee was recently "written up" for the third time in a year for improper protection of stored-in-place-equipment, and the corporate management reacted very forcefully. This factor causes one to ask how much of the quality emphasis is because of a need to satisfy the Nuclear Regulatory Commission. The following observations were made by NRC inspectors as this question was discussed:

- They consider the Licensee's plant an average construction job, except above average in doing their own quality control.

- They feel that quality assurance and quality control are both good and adequately staffed and trained.

- They are impressed with the construction craft training programs at the site.

- They feel that upper level management should be at the site more often.

III. REMEDIAL ACTIONS TAKEN TO CORRECT QUALITY PROBLEMS

As previously stated, there have been no major construction-related quality problems at the Licensee's site. There have been, however, a number of typical problems that arise in the course of construction. Some of these are described to illustrate the type of problems encountered, how the Licensee has responded to deficiencies in quality, and for background to the Licensee's responses in the interviews. Most of these problems have been alluded to earlier in the Report. The following list is comprised of those problems that the Case Study Team became aware of during the site visit:

1. Early in construction, an NRC inspector identified an erosion problem due to rain during excavation for the plant. The Licensee initially disagreed that this was a problem, but subsequently agreed that it was a potentially very serious one and, as a result, took corrective action. This particular quality problem was felt to be significant for two reasons: (a) it established early on that the NRC would be insistent about correcting potential problems, and (b) it was a real physical problem identified by on-site NRC inspection, rather than a procedural or records problem detected in a paper audit.

2. The Licensee has been concerned over the number of field change requests and nonconformance requests that have been required in the design. While the volume of field change requests and nonconformance requests is greater than other projects out of the AE's home office, there may be a good reason why it is greater. As a result of monitoring the number of changes, the Licensee has insisted that the AE's design procedures be audited. The changes are being categorized by discipline (mechanical, electrical, or civil) to determine which group(s) need attention. This activity resulted in the home office checking to make sure the remaining drawings are more closely reviewed. It appeared likely that the AE would assign a quality assurance person from the home office to the Licensee's site.

3. The Licensee at one time had a problem with rock pockets in the surface of thin concrete walls (12" thick). This problem was resolved by reducing the pour lifts from 12' to 6' and increasing the attention given to vibrator technique. An innovative practice subsequently put in place for thin wall high lift pours is forming one side with plexiglass. This permits QC and construction forces to observe directly the placement and vibration of the concrete. In addition, through-the-form vibration with inspection ports are now used quite extensively.

4. During the plant walk-through, it was noted that a hold tag had been placed on a spray ring pipe spool because center punch marks near each end of the spool were considered too deep. The QC inspector had to have examined the approximately 30' long spool piece very closely to have found these marks.

5. The Licensee had been notified of inadequate storage requirements for installed electrical equipment. While the supervisor in charge had given instructions to his field coordinators to correct the deterioration of the storage process, it was not done. The supervisor acknowledged this problem as his responsibility. As the team probed for root causes in this situation, it was noted that there was no finger pointing. The supervisor felt that the cause was inadequate procedures and followup. The information flow from engineering to field coordination was verbal. The procedures for conveying the information were weak; i.e., there was no form nor paperwork. The supervisor said he thought the system was working and that the periodic inspection checklist covered this item. As a result, the Licensee was considering establishing a contractor crew to ensure that storage measures are sustained.

6. There has been difficulty with respect to the quality assurance on piping spools. It was noted that the Licensee examined all of the prefabricated piping spools and did, while finding no significant quality defects, spend considerable time in correcting well spatter and surface defects.

IV. GENERIC IMPLICATIONS

Based on the information reviewed and analyzed by the Case B Study Team, several possible generic implications, or lessons, emerge. These are highlighted for each case study to provide input and to help form overall conclusions concerning factors which constitute important elements in nuclear plant construction quality.

1. The importance of the Licensee managing the project. The Licensee has clearly accepted responsibility for the completion of the project and the quality of the overall work. As a result, it has instituted practices that permit it to dictate the scope and degree of quality on the project. The Licensee manages the day-to-day activities of each contractor. Their field coordinators review the design for constructability. They have instituted audits where appropriate for their subcontractors.

2. The importance of experienced personnel. The Licensee has staffed the project rather broadly and deeply with personnel with substantial experience, both in general construction, as well as in nuclear construction. Many of the staff have 5-10 years with the Licensee, have worked on the previous nuclear plant constructed by the Licensee, or on other nuclear plants.

3. The importance of good training programs. Many of the Licensee's staff, as well as the construction contractors' staffs, undergo training programs. Some of the training has been instituted because there is limited availability of skilled labor in the area. The Licensee and its contractors train crafts and staff in quality control. In many cases, they have found that in training new personnel, there are fewer bad habits to overcome.

4. The importance of planning. Nuclear projects are complex projects and require extensive planning and coordination. The Licensee's projects seem to be well coordinated with interfaces generally well handled. The construction staff does not appear to be standing around; that is, productivity appears good. Evidence of the planning is also manifest in preparation of the operations staff with 80 engineers already on the staff. The Licensee has a training center and has sent staff to other reactors for training. Lessons learned from their previous nuclear project, as well as other projects with the holding company's purview, have been fed back into the Licensee's construction project.

5. The importance of a pro-company attitude among the employees. The Licensee's staff appears to enjoy working for the Licensee. Comments were made about fairness, opportunity for advancement, and rewards for hard work. The Licensee appears to be a people-oriented company, in that layoffs are relatively rare, and the company provides a good pay scale with good finge benefits.

6. The importance of an orientation toward quality. There seems to be a perception at all levels within the Licensee's staff that quality is highly important. At the higher levels of management, there is a conviction that public safety and company profitability demand quality and that it is less expensive to do the job right the first time. At lower levels, there is a feeling that upper management wants to do the job right. Many of the staff were able to identify the signals that tell them that; and that quality is at least as important as schedule and cost.

7. The importance of management support of quality. This is evident in the qualifications of the personnel that have been hired in both the quality assurance and quality control functions. It is also evident in the programs for these types of personnel as well as crafts. It was apparent from interviews that quality assurance/quality control personnel were respected by management, and that management supported them when it was necessary to stop a job when adequate quality was not manifest.

8. The importance of the seeking of ways to improve quality. There is an attitude within the Licensee's organization that it has no monopoly on good ideas. It looks far and wide for ways to improve its QA program. The Licensee was first to be evaluated under 10CFR50 Appendix B. It has been proactive in looking at others' quality assurance programs. It was one of the pilot studies for the INPO audit and it has also embraced the idea of self-initiated evaluation. They were open to participation in the NRC case studies. A number of their senior staff were on retreat at the time of the case study to consider ways to improve the quality program at the site. The Licensee expressed considerable interest in good practices that the Case Study Team had noted at other sites, and subsequently at least one contact was made at the Case A site. They appeared to be more interested in finding out where they could improve than in knowing what they were doing right.

9. The importance of openness. The Licensee exhibited an openness in encouraging its employees to identify quality problems without fear of punitive action. In addition, they are open to the NRC in its activities at the site. There is no attempt to hide marginal practices from the NRC inspection staff.

10. The importance of experience in the construction of nuclear plants. The Licensee learned a great deal from the construction of its initial nuclear station, including an understanding of the magnitude and complexity of a nuclear project.

11. The importance of top management involvement in nuclear projects. The Licensee has seen fit to establish a Project Management Board for its nuclear project comprised of senior utility management personnel involved in the project. This type of activity enhances resolutions on problems and helps keep management informed. Top management appears to have made a resolution to spend more time at the construction site.

V. IMPLICATIONS OF THE CASE STUDY FOR NRC QA INITIATIVES

NRC has underway or under study a number of initiatives which are designed to establish additional confidence in the quality of design and construction of nuclear facilities, to improve the management control of quality and/or to improve the NRC capability to evaluate the implementation of Licensee assurance of quality programs. These initiatives are described in the NRC staff paper SECY 82-352 titled, "Assurance of Quality," and subsequent correspondence between the Commission and the NRC staff. One of the purposes of this Case Study is to provide feedback regarding the relevance of the various initiatives to this Licensee's nuclear construction project. Subsequent paragraphs take each initiative in turn and discuss whether the initiative, had it been an ongoing activity at the time of the Licensee's construction program (or quality problems, if such occurred), would have made a difference. That is, would the initiative have helped prevent or at least mitigate construction quality problems that may have occurred or, in the case of this Licensee, would it have improved the quality of the plant.

A more complete discussion of the scope and details of the various NRC QA initiatives may be found in SECY 82-352 and SECY 83-32 titled, "First Quarterly Report on Implementation of the Quality Assurance Initiative."

It should be noted that each of the initiatives were discussed with senior management of the Licensee and they agreed (or did not take exception to) the Study Team's evaluation of the applicability of the initiatives to their own prior construction experience.

A. Measures for Near-Term Operating Licensees (NTOL)

1. Licensee Self-Evaluation - not applicable for current phase of construction

   The Licensee self-evaluation is an action that would take place when the Licensee is in the process of receiving its operating license. The effect of the Licensee self-evaluation would not have taken place up to the present phase of construction of the plant, which is about half completed and, thus, its effect on the project is not applicable.

2. Regional Evaluation - not applicable for current phase of construction

   The Licensee regional evaluation is an action that would take place when the Licensee is in the process of receiving its operating license. The effect of the regional evaluation would not have taken place up to the present phase of construction of the plant and, thus, its effect on the project is not applicable.

3. Independent Design Verification Program (IDVP) - not applicable for current phase of construction

   The Licensee IDVP is an action that would take place when the Licensee is in the process of receiving its operating license. The effect of the IDVP would not have taken place up to the present phase of design of the plant, which is about 70% complete and, thus, its effect on the project is not applicable. Design verifications can be performed at any stage of design, of course, but are most productive when the design is completed. Should the time come when nuclear plant design is completed substantially in advance of construction, then an independent design verification program could be an effective guard against allowing quality deficiencies in design from creeping into construction. However, the present NRC practice of requesting some licensees to submit to an IDVP prior to receiving an operating license would not be applicable in this case.

B. Industry Initiatives

1. INPO Construction Audits - yes
While no major construction quality deficiencies have been found in the icensee's plant to date, the Licensee implied that the INPO pilot audit had been helpful in identifying areas that should be improved. This measure looks at both management and programmatic considerations as well as the quality of the product. Licensees tend to listen to INPO findings because they come from people who should be experts and they come from a group comprised of their peers, supported by their industry.

2. Utility Evaluation Using INPO Method - yes
This measure is basically a self-evaluation using the INPO methodology devised above. As a result of the design audit done by INPO in early 1982, self evaluation design review teams were established to conduct a more extensive review. This review is estimated to require more than 15,000 manhours of effort. The review teams are led by representatives from the architect-engineer who were not involved in the original design. The team includes Licensee personnel; Licensee holding company engineering function staff are representatives also.

C. NRC Construction Inspection Program

1. Revised Procedures and Increased Resources - yes
The resident inspector program at the Licensee's site is well thought of and its recommendations have been well received. This initiative would be particularly helpful if: (a) the NRC inspection procedures were streamlined to eliminate redundancy and given priority according to safety significance; (b) its focus was more on observations of actual construction work and less on paper and reports, and (c) a focus on the quality of management of the project and less on the formal QA manual, organization chart, and written procedures. Further, the increased NRC inspection resources should be applied from the outset of the construction project.

2. Construction Appraisal Team (CAT) Inspections - yes

   While the Licensee's project has not been subjected to significant quality problems, the Licensee has benefited from audits of various types, as well as NRC inspections. The Licensee appears open to the benefits that come from these inspections; however, several comments were made concerning the large number of audits being made, including those by the Licensee itself, the NSSS vendor, the architect-engineer, ASME, NRC, and INPO, among others. The proper timing and spacing for audits appears to be an important consideration in their effectiveness, otherwise they could become counterproductive.

3. Integrated Design Inspection - yes

   Depending on when the integrated design inspection is performed, it could be of benefit. If the integrated design inspection is done when the Licensee is in the process of receiving its operating license, it would not have taken place up to the present phase of design of the plant; thus, its effect on the project would not be applicable. If it were done as selected systems were completed, it could be of benefit. It is believed that the Licensee would be receptive to an integrated design inspection. Comments made in Item A.3 would also apply here.

4. Evaluation of Reported Information - yes

   This initiative would computerize 10CFR50.55e and Part 21 reports, facilitating trend and other analyses of these event reports. This analysis would simply provide an additional cross check on the quality operations at the Licensee's site. At the present time, there is no reason to believe that there would be any observed trends from the reports, but they could be useful to the NRC (as well as the Licensee's) staff in directing their inspections at the site.

D. Designated Representatives - no

At the time this Case Study was conducted, it was unclear how a designated representatives system would be implemented by the NRC. The FAA uses designated engineering representatives (DER) who are employees of manufacturers deputized by the FAA to review and verify certain elements of design. They also designate manufacturing representatives to verify that the assembly or fabrication process is acceptable. The DER could be used to spot check the design or design process. With the Licensee's effective QC system, it is not clear that a designated representative program would make any difference. The Assistant Construction Project Manager said with respect to quality assurance holds, it would be relieving the Licensee of responsibility. Inspectors must be in the process, or they would not be helpful in solving emerging problems, he said. At the present time, there are holds for quality assurance and he saw no reason why additional ones would be beneficial. The civil project construction supervisor concurred in this. He thought they would create no more quality than they have now.

E. Management Initiatives

1. Seminars - yes

The seminars similar to those that the NRC Commissioners have conducted in years past, as well as seminars by trusted utility executives, would probably have been helpful in bringing the Licensee's management to their present state of awareness of the importance of quality at an earlier date.

2. Qualifications/Certifications of Quality Assurance/Quality Control Personnel - no

The Licensee already has a very strong training program for its quality control personnel, as well as its quality assurance personnel. The Quality Assurance/Quality Control staff was noted to be deep and broad in its qualifications. When hired, these qualifications are then further developed through formal classroom and on-the-job training. The recruitment for quality assurance people stresses degreed persons with experience in the practical side of the nuclear industry. Many of the QA/AC staff brought strong nuclear experience

to the Licensee when they hired on. There was some indication from the interviews that a few QA/QC management personnel might profit from training programs with a management thrust. Such a program might enhance NRC confidence that an appropriately qualified staff was in place.

3. Craftsmanship - yes

While there is a very good training program for craftsmen at the Licensee's site, management interactions with the craftsmen would reinforce their understanding of why quality workmanship is of prime importance in the construction of nuclear plants.

F. Certification of QA/QC Programs (SECY 83-26) - maybe

As previously stated, the Licensee has hired QA/QC personnel with good qualifications and experience. Certification or reaffirmation of QA/QC programs could add to the quality or know-how of the staff perhaps only marginally. Such a program might enhance NRC's confidence that an appropriately qualified program was in place. Certification is not seen as addressing the types of problems that the Licensee has experienced to date. The Licensee management has treated QA/QC as something more substantive than other regulatory requirements. They look upon it as an integral part of assuring that the project is completed without significant rework and with the potential for satisfactory operation over its lifetime.

G. Management Audits - maybe

At the present time, the Licensee is examining its management structure and general approach to quality, looking for new and innovative methods of improving assurance of quality in the construction of their nuclear project. The fact that inquiries are presently going on suggests that the management audit might be a helpful input to their decision-making process. The Licensee did not express itself on this particular issue, however.

VI. IMPLICATIONS OF THIS CASE STUDY FOR THE FORD AMENDMENT ALTERNATIVES

Section 13 to NRC's FY 1983 Authorization Bill requires NRC to conduct a study of existing and alternative programs for improving quality assurance and quality control at nuclear power plants under construction. This section, called the Ford Amendment, requires NRC to look in particular at the feasibility and efficiency of five specific alternative program concepts. As a part of this analysis, each alternative concept was evaluated with respect to whether it would make a difference in the Licensee's construction program had it been in place at the time of the Licensee's construction permit. As was the case with the quality assurance initiatives, each of the Ford alternatives was discussed with senior utility management, as well as with their staffs.

A. More Prescriptive Architectural and Engineering Criteria - no

The Authorization Act requires NRC to evaluate the following alternatives: 13(b)1 - adopting a more prescriptive appraoch to defining principal architectural and engineering criteria for the construction of commercial nuclear power plants would serve as a basis for quality assurance and quality control inspection and enforcement actions. Generally speaking, the Licensee believed that NRC is sufficiently prescriptive in defining principle architectural and engineering criteria for construction of nuclear plants and that it is not necessary to be more so. The problems the nuclear plants have in quality would not be significantly changed if there were more prescriptive criteria.

B. Conditioning the Construction Permit on the Applicant's Demonstration of His Ability to Manage an Effective Quality Assurance Program - yes

The Authorization Act requires NRC to evaluate the following alternative: 13(b)2 - requiring as a condition of the issuance of construction permits for commercial nuclear plants that the Licensee demonstrate the capability of independently managing the effective performance of all quality assurance and quality control responsibilities for the plant. The Licensee senior management was in agreement that prospective licensees should be required to demonstrate to a panel of peers the capability to manage a nuclear project. In the case of the Licensee, it would have resulted in an effective quality assurance program sooner. The Licensee is an advocate of peer review. Their viewpoint is that the NRC does not have the necessary resources to police the industry and should not have to do so. This responsibility should be with the licensees themselves, or the utility industry in general. Several suggestions were offered regarding how a licensee with no previous nuclear plant experience might accomplish this. The most feasible one was a procedure similar to what the ASME does for new N Stamp applicants; i.e., the applicable procedures involved need to be exercised on a demonstration project or task.

C. Audits, Inspections, or Evaluations by Associations of Professionals Having Expertise in Appropriate Areas - Management Audits - yes

Regarding audits by independent organizations, the statement was made that the system should not be made any more complicated than it currently is. It is important to keep the responsibility for implementing an adequate quality assurance program with the Licensee, with the Nuclear Regulatory Commission in a verification role. The NRC CAT Team audits were felt to be a worthwhile approach to verify adequacy of work at construction sites. Most every employee interviewed commented on the number of audits being conducted by a variety of organizations. The audits are becoming a problem, as they impact the time that personnel have to do their job, thereby reducing both quality and productivity. The audits can highlight problem areas to the overall benefit of the project. The Licensee commented that audits have become a way of life and that the Licensee just lives with it.

Negative reaction was obtained to the policy of NRC and INPO publishing the audit findings to the public. The nuclear industry has all its problems aired to the public, causing loss of confidence by the public, because they continually hear of the nuclear problems, blown out of proportion.

The Licensee also felt that the Nuclear Regulatory Commission should be audited by an independent organization, but could not identify the appropriate organization to conduct such audits.

D. Improvement of NRC's QA Program - yes

The Authorization Act requires NRC to evaluate the following activities: 13(b)4 - reexamining the Commission's organization and method for quality assurance development review and inspection, with the objective of deriving improvements in the Agency's program.

Several suggestions arose from this Case Study: (1) assignment of a resident inspector at start of construction would not have been much of benefit to the Licensee. The Licensee knew from previous experience how to manage and got started off correctly. For less experienced utilities, though, the Licensee felt it would be necessary to assign an inspector very early; such as when basemats are poured and cadweld work is beginning. An NRC inspector should be assigned the first day of the project. This is important, because it is then that relationships and procedures begin to develop; (2) the Licensee felt more and better help from the NRC is required. NRC Headquarters needs to become more active in and share in meaningful decisions that affect the industry and then stand by their commitments; (3) inspectors should not be so paperbound. There is too much emphasis on the size of reports flowing to Headquarters. The 15 volumes of field procedures that exist now is overkill. In fact, the old manual was sufficient. Inspectors should be free to be in the plant and not excessively deskbound by bureaucratic work; (4) some inspectors are not systems or management oriented; i.e., they are too concerned with specific nuts and bolts-type problems to look further and see systemic problems; (5) too many construction permits were issued in the same time period, causing NRC inspection to be stretched too thin; (6) the NRC CAT Team inspections seem valuable. Standard review plans are good. The NRC major effort should be to ensure that quality assurance is finding problems (not generating paperwork); (7) NRC tends to monitor what the

Licensee says, rather than what the Licensee does. It was noted that if there is too much direction from NRC, it stifles initiative; (8) the biggest argument with quality assurance is over the applicability of codes; not so much the ASME Code, but the ANSI daughter standards, especially in the areas of training and housekeeping. Persons tend to interpret these standards either as guidelines or as requirements engraved in stone. What is needed is a more definite interpretation of standard requirements by NRC -- one that is more consistent on a region-by-region basis.

E. Conditioning the CP on the Applicant's Commitments to Submit to Third-Party Audits of His QA Program - yes

The Authorization Act requires NRC to evaluate the following alternative: 13(b)5 - requiring as a condition of the issuance of construction permits for commercial nuclear power plants that the Licensee contract or make other arrangements with an independent inspector for auditing quality assurance responsibilities for the purposes of verifying quality assurance performance. An independent inspector is a third party who has no responsibilities for the design or construction of the plant.

This alternative as it applies to this Case Study has been discussed under Ford Amendment Alternative 3 above. Basically, the Licensee was already committed to a quality program based on its experience with a previous nuclear station. Over the time period since construction has continued, the Licensee has become increasingly positive in developing a sound QA/QC program.

APPENDIX A

EVALUATION OF GENERIC KEY INDICATORS FOR CASE B STUDY

KEY TO EVALUATIONS:

C - CONSTRUCTION SUBTEAM
Q - QUALITY ASSURANCE SUBTEAM
E - ENGINEERING SUBTEAM

CASE B
EVALUATION OF GENERIC KEY INDICATORS

1.0 Licensee fully committed to a program for assurance of quality

a. From the interviews conducted both at the corporate offices and the site, it was evident that a sense of commitment to quality pervades the Licensee organization at all levels. There were repeated remarks that indicated an understanding that the Licensee wants the plant "built right the first time."

The Licensee volunteered for the first INPO Design Audit and has expanded on it with their own extensive design audit.

QA/QC has access to the Executive Vice-President directly and there was no indication of cost/schedule overriding QA/QC.

(C)

b. Senior management was deemed to be actively involved and knowledgeable in all areas of activity of the site with emphasis on quality about on par with schedule and cost. Staffing and material resources provided for control of the quality function appeared adequate; however, staffing of a quality engineering activity to perform specific task planning, especially for the receiving inspection cycle, seemed to be advisable. High emphasis on the Quality Control function was apparent. Positive messages about the Licensee's commitment to quality came from personnel at all levels of the Licensee's organization as well as from the contractors. The commitment to quality was seen as being long term (i.e., for the life of the plant) rather than meeting a short-term goal such as obtaining an operating license.

(Q)

c. The upper and lower echelons of management say they are fully committed to a program for assurance of quality and, as far as was determined, they are. The motivation, however, seems to stem less from a burning desire for quality per se than from a concern of not having adequate quality and the consequences which could emanate from that. To elucidate on the preceding observation, it is necessary to compare Case B with something, and the only other site visited to this point is the Case A site. The Case B site does not exhibit the same intensity and enthusiasm for quality that one senses at the Case A site. The difference is manifest in (a) the regular involvement of upper management in the activities of lower echelons as they relate to actual construction of the plant, and (b) the lower management and their staff insistence that quality is first (or possibly safety, then quality) without a clear and consistent understanding about where the driving force for quality originates (sometimes expressed as NRC requirements). This apparent inconsistency may arise from the appraisals which list quality first (or sometimes safety, then quality) before other measures of employee performance. It was difficult to determine whether interviewees were responding to questions about the importance of quality from the standpoint of their appraisals or from a clear signal from management concerning quality.

(E)

2.0 Responsibility and authority are clearly defined and properly implemented

a. The overall responsibilities and authorities appear to be clearly specified and well understood by the project participating organizations. It is clear that the Licensee has structured these in such a way that it is completely in control of all activities and is, in fact, "running the job."

There appears to be some overlapping of responsibilities between the Licensee's Construction Coordination Group and their project sections; however, their authorities seem clear and both components report to a single manager. Therefore, this is not considered to be a problem.

(C)

b. Overall, the responsibilities and authorities for each organization were adequately documented and apparently implemented. Personnel within the project and with the major subcontractors were always knowledgeable of their own as well as others' responsibilities and authorities; however, the organizational structure is quite complicated and not easily understood by an outsider. Geographical separation of some of the major organizations from the construction site were seen to somewhat hamper organizational efficiency (e.g., AE's home office performs the design and procurement activities which then must be coordinated with the Licensee at the construction site).

(Q)

c. Responsibility and authority appeared to be clearly defined and, for the most part, properly implemented. The "Project Triangle" (the communication problem arising from having the AE's home office in one location, the NSSS vendor and mechanical contractor's home offices at another location, and the project site at a third location) and the division of responsibilities between the AE and the engineering services function tend to complicate responsibilities and authorities -- if not on paper -- then in practice. The potential vulnerability in the triangle may reside in design-related quality matters, which were not assessed. In the one example of a deficiency in quality (failure to maintain appropriate temporary protection for electrical switchgear) there was no evidence of finger pointing, suggesting that responsibility was properly understood. The fact that no construction is done, except from the AE approved drawings, and that "redlining field changes would get you fired," also supports the acceptance of responsibility/authority.

(E)

3.0 Personnel are adequately qualified for assigned work

a. Records relative to this factor were not reviewed; however, the persons contacted, in general, had good qualifications for their assignments.

There is a good base of nuclear experience at the site. Some people in key management positions and in QC have less experience than one would expect. This is not cons ered to be serious, but is felt to be marginal.

In part, the lack of experience is offset by a substantial training program and an overall impression of a high level of dedication and enthusiasm.

(C)

b. The Licensee and its major contractors have a good program for obtaining qualified personnel and furthering their training. Key personnel have previous in-depth nuclear experience from either the Licensee's earlier plant for from other nuclear projects, which has been further enhanced by in-house training. Early in construction, crafts people were recognized to need further training on how to do nuclear work, which has resulted in a comprehensive blue collar training program.

(Q)

c. Personnel are generally qualified for assigned work. A number of the first and second line project engineering/design supervision have had about 5-6 years of nuclear experience. Often a year or two of that was on later phases of the Licensee's initial nuclear station prior to moving to the Case B station. This amount of experience is probably not enough to have seen all the things that can go wrong in nuclear plant construction activities.

(E)

4.0 Instructions, procedures, and drawings are clear and adequate

a. It was found that specific insturctions to the crafts in the form of Process Data Sheets (PDS) are used only on the ASME Code covered work. Further, an unusually large number of Field Change Requests (FCRs) have been generated in the past few months. Although it has not been confirmed, it is suspected that many of these FCRs are resulting from dimensional conflicts between different items in the installations.

An expanded use of PDSs and a more thorough checking of design dimensions could improve this situation.

(C)

b. This area was not evaluated to any great extent by the subteam.

(Q)

c. Overall instructions, procedures, and drawings appear adequate, though some are only manually logged (as for Field Change Requests) and listings are not routinely sent to all interested parties (e.g., one must go to the log to review entries). Procedures are not up to date. In the case of the failure to maintain protection on electrical switchgear (Item 2), the comment was made that verbal instructions had been given to the construction coordinators to correct the condition, but there were no procedures or paperwork, and it fell through the cracks. The periodic inspection check list was thought to cover this item, but it didn't.

In another case, desktop instructions which can govern some of the more significant details of drawing/specification control, are not monitored for consistency among the project specifications.

(E)

5.0 Quality and/or QA program deficiencies are identified and reported promptly and clearly

a. There were numerous comments and indications that management has a strong desire for problems, deficiencies, and areas of improvement be identified whenever possible. Statistical reports on deficiencies, nonconformances, etc., are routinely provided by QA to Project management. It was felt that the usefulness of these reports, in terms of trend analyses, could be improved.

One such improvement being considered is to categorize the deviations and nonconformances in a way to improve trend analyses. Such categorization may be according to the judged seriousness of such occurrences.

(C)

b. Policies and directives about reporting QA/QC deficiencies exist and are being implemented. Increasing the visibility of these policies would seem to be of further benefit. Quality Control is very strong in the civil/structural area wherein a hold point system works in a very effective fashion; however, some work is inspected on a catch-as-catch can basis (e.g., electrical installations). Quality performance data and trends are reported and acted upon by management in a timely manner.

(Q)

c. The large number of Field Change Requests and nonconformance requests (1389 FCRs and 463 NCRs during the period October-November 17, 1982) may suggest some type of deficiency in the design process. The fact that the Licensee does not permit redlining to facilitate field changes accounts for part of the number. Also, the project engineering sections review drawings for constructability, and these reviews turn up a number of required design changes. Nonetheless, the number is large and AE home office design function is being audited on this item.

The Licensee's project team has been audited by NRC, INPO, and a host of others to the point where one member of the project staff commented that there are too many audits and that they can become demotivators.

Conformance to design appears to be tightly controlled by field QC inspectors.

(E)

6.0 Corrective action program is effective

a. Not investigated by "Construction" subteam.

(C)

b. The Licensee and its contractors have a quite good corrective action program which seems to be effective in bringing about needed change. The QC people seem to have higher favor with upper management when it comes to bringing about rapid change. The QA people are also listened to, but management seemed more cautious about accepting their proposals and recommendations.

(Q)

c. The corrective action program was noted only peripherally with regard to the electrical switchgear protection problem and the design audit problem. In one case, the problem escalated prior to corrective action; in the other, corrective action was self-initiated or recommended by the INPO audit.

(E)

7.0 Design reviews, including independent reviews, detect and clearly resolve design deficiencies

a. The INPO audit and subsequent internal, independent Design Reviews appear to have been effective in identifying and resolving problems or deficiencies in the areas of engineering analysis and content of the design. However, a very large rate at which FCRs are being generated may indicate a weakness in the design review for dimensional problems and constructability. There is an element of risk that these more pragmatic design issues may impact the quality.

It is significant that the plant operations staff has reviewed both the design criteria and the completed designs for operability and maintenance needs.

(C)

b. This area was not evaluated by the subteam.

(Q)

c. As previously stated, there has been a large and, apparently, continuing number of FCRs and DCNs at the licensee's project. Design reviews by the AE have not detected and clearly resolved design deficiencies as evidenced by the number of Field Change Requests; however, this problem has been recognized, and increased design review activity is in process. Various reasons were given for constructability. This appears to be the major design review. No data were obtained on the independent design reviews within the AE's organization.

(E)

8.0 Design input data are adequately controlled

a. The utility, through its Engineering, Operations, and QA organizations, has participated in the review of the design criteria and has made significant inputs to some design features; i.e., the Control Room. The degree of formalization of this process was not investigated.

(C)

b. This area was not evaluated by the subteam.

(Q)

c. Limited information was obtained on control of design input data. Design drawings appear to be adequately controlled in the field, and design changes arising in the field appear to be adequately controlled. Design conformance to NRC and code requirements is managed in the AE's home office.

(E)

9.0 Complex organizational structure and arrangements do not contribute to poor assurance of quality

a. The organizational structure, once it could be understood, is considered appropriate and adequate. However, it was difficult to understand functionally, because unusual titles and component names are used. In the interviewing process, it was found that this practice is resulting in potential communications problems, because components were referred to by different functional titles by different people. The use of more functionally descriptive titles could reduce the confusion potential.

(C)

b. The structure is well documented and was judged to work fairly effectively, even though it is quite complicated. Organizational independence is provided for those groups responsible for performing verification and audit activities, both within the utility's and the subcontractor's organizations.

(Q)

c. Within the Licensee's project team, the organizational structure was straightforward. The divisions of responsibilities and authorities did not have apparent overlaps.

It was commented on that there had been better communication between project engineering and quality assurance when the latter was housed in the same building. As the staffs increased in size and the building became overcrowded, the QA staff was moved to another building outside the construction area. One wonders whether upper management considered this effect in making the move, and what measures were taken to compensate for it.

(E)

10. Planning, scheduling, and budgeting activities allow for adequate resources to do the job correctly

  a. The "Construction" subteam probed this factor to only a very limited extent. The efforts on providing short-term construction schedules appeared good. These include daily, weekly, 6-week, and 3-month plans. Although these schedules are provided to QC, there were indications that assuring QC inspectors are at the right place at the right time is handled rather informally in practice.

  (C)

  b. Work was observed to be on schedule and chronic delays were not evident. Subtle messages to cut corners and get the job done were not evident, either. Procedure compliance is stressed at all levels and daily work schedules appear realistic enough to allow work to be completed in accordance with those procedures.

  (Q)

  c. The overall cost/schedule activity appears quite adequate, although there seemed to be some problem in projecting the actual productivity of the mechanical contractor. Budgeting was not assessed in detail. The leadtime that is built into the schedule is as follows: all equipment is to be onsite within 11 months of the time it is needed; all design 7 months; and 90 days before an operation is to proceed, all other supporting facilities and expendable materials are to be on the site. Even with the large distance between the designer and the plant site, the time difference, and the large number of FCRs and DCNs, the design process seemed to be going smoothly.

  (E)

11.0 Design control process

a. The design review and audit activities were discussed in Indicator 7. These audits have been documented.

Field Change Requests require formal approval by appropriate design agency representatives and are well controlled.

As discussed in Indicator 7, there is some concern as to the adequacy of design review for application and constructability.

(C)

b. This area was not evaluated by the subteam, but it was noted that a large number of Field Change Requests are being processed.

(Q)

c. The design control process, apart from that performed at the construction site, was not reviewed. The design control process at the site, as far as procedures were concerned, appears quite adequate.

(E)

12.0 Work package development and control

a. As discussed in Indicator 4, this area could be strengthened by more extensive use of Process Data Sheets.

A "Work Package" system is used for procurement. but the extension of this to construction was identified only through the concrete pour cards and the travellers used on ASME code work.

(C)

b. The civil area was seen to be very strong. Control over other contractor operations was judged also to be good, with the exception of the electrical contractor. Also, receiving inspection relies on generic inspection requirements, rather than specific planning.

(Q)

c. Not reviewed.

(E)

13.0 Procurement control

a. The procurement process was not investigated in depth by the "Construction" subteam.

It was identified that source inspection is performed on specified items by the engineering groups, including both the AE and the engineering services function. There is documented evidence of receipt inspections; however, it was determined that the inspection instructions should be strengthened.

(C)

b. The AE handles all front-end activities related to procurement and no evaluation was made in this area. On the receiving end of procurement, acceptance is pretty much limited to an accountability and paper review exercise. Little or no overcheck activity occurs; thus, deficient materials or items may not be discovered until point of installation.

(Q)

c. Not reviewed.

(E)

14.0 Nonconformance control

a. Not investigated by "Construction" subteam.

(C)

b. The Licensee's quality program is oriented heavily towards detecting discrepancies (receiving inspection excepted) and a good program for controlling nonconforming items exists once they are identified.

(Q)

c. Not reviewed.

(E)

15.0 Special process controls

a. Such controls are being applied where required by codes, but could be extended in greater depth to other areas as discussed in Indicator 4.

(C)

b. A comprehensive program exists for qualifying special process operators. The program even has requirements for qualifying fitters.

(Q)

c. Not reviewed.

(E)

16.0 Examination, test, and inspection control

a. All indications were that the licensee is doing a well above average performance in this area. It is considered significant that the utility efforts on QC are very extensive -- a staff of about 250.

(C)

b. For the most part, these processes looked well controlled. The electrical contractor was seen to be an exception. Hold points here were not really hold points. If an inspector was not available when needed, work would still proceed.

(Q)

c. Not reviewed.

(E)

17.0 Calibration control

a. Not investigated.

(C)

b. The calibration program is managed by the Licensee at the site and was judged adequate. Evaluation was limited to discussions with the supervisor, observance of processes within the test laboratory, and checking numerous calibration status labels in the field.

(Q)

c. Not reviewed.

(E)

18.0 Records

a. Not investigated.

(C)

b. Overall, the records program was deemed adequate. The records storage facility was found acceptable and the personnel well informed and directed. The menu for retrieval of information was not extensive, which would mean that data retrieval may be slow.

(Q)

c. Records were not reviewed in sufficient detail to make an adequate evaluation.

(E)

19.0 Audits

a. There were numerous indications that audits have been both frequent and numerous.

(C)

b. The audit program was judged quite strong. Numerous audits are performed by qualified people by various organizations (e.g., the Licensee, the engineering services function, and the AE). The audits are frequent, comprehensive, and detailed.

(Q)

c. With respect to audits, the comment was made that there were training programs for a variety of job assignments, but more frequently than not, the supervisor or manager had not audited the program that his subordinates were required to attend. In another case, the discipline project supervisors require their engineers to audit parts of the construction twice a year. In some cases, the engineers need to come in on their days off to do the audit, because of the press of work. There was no evidence of this practice being carried out in a routine and orderly manner.

There was not sufficient evidence that the middle and upper management get to the construction workplace with any degree of regularity. On the other hand, several of those interviewed mentioned day-long sessions with corporate officers inquiring in detail into those persons' activities.

(E)

20.0 Corrective action

a. The subteam was impressed by the corrective actions which have been applied, particularly relative to concrete placement. These have included:

- Reducing the height of pour lifts in thin walls to reduce the air pockets

- Forming one side with plexiglass so that vibration can be directly observed during placement

- Training vibrator operators

(C)

b. Good responses to quality problems were evident in review of the audit reports sampled. Corrective actions are implemented in a timely manner by responsible management.

(Q)

c. Corrective action was not reviewed in detail.

(E)

21.0 Identification and control of materials and items

a. This was not investigated in depth; however, since all procurement, storage, and site disbursement of materials is done by the utility, it is suspected that the control is very good.

(C)

b. The subteam saw no evidence that this was any large problem, either in the storage areas or on installed piping and equipment in the plant. Nuisance-type vandalism was reported to occur with fair frequency. Many areas that contained installed euqipment were locked and entrance administratively controlled to minimize these occurrences.

(Q)

c. Not reviewed.

(E)

APPENDIX B

Definition of Levels of Quality Failure Causes

1. The Deepest Sense of Quality Failure

   There are basic underlying causes of quality failure, which clearly transcend QA and QA programs. They can be characterized as broadly philosophical. They are at the extremity of the chain of causes (e.g., building a nuclear power plant without knowing how -- which has as necessary conditions (1) the Licensee does not know how, and (2) NRC permits them to build, even though they don't know how). It is usually very difficult, if not impractical, to develop recommendations that address such philosophical issues. They are, of course, the root causes. For the assessment process, root causes are defined at an operative level.

2. The Operative Sense of Quality Failure

   There are basic underlying causes of quality failure, which frequently transcend QA and QA programs, but not necessarily. They can be characterized as general. They are near the end of the chain of causes, but are limited to where it is practical to bring about corrective action (e.g., lack of management commitment). It is at this level that corrective actions often treat many symptoms of poor quality. It is in this sense that the term "root causes" applies in this Report. There is a third level which we have defined as symptomatic/procedural. Secondary root causes may fall in either the second or third levels.

3. The Symptomatic/Procedural Sense of Quality Failure

   These are the causes of quality assurance failures. These can transcend QA and QA program, but it is unlikely. They are characterized as detailed and specific. They are intermediate in the chain of causes and, as such, are subcauses of (2) above. Recommendations for corrective actions at this level are relatively easy, but are likely to treat individual symptoms without curing the disease.

Battelle
Pacific Northwest Laboratories

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CONSOLIDATED DESCRIPTION

QUALITY ASSURANCE PROGRAM

MARBLE HILL NUCLEAR GENERATING STATION

PUBLIC SERVICE COMPANY OF INDIANA, INC.

DOCKET NOS. STN 50-546 AND 50-547

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APRIL, 1980

INTRODUCTION

This document provides a summary of the Quality Assurance Programs being employed in the design, procurement, construction and construction phase testing of safety-related components, systems and structures of the Marble Hill Nuclear Generating Station. It describes the interfaces between Public Service Company of Indiana, Inc. (PSI), Sargent and Lundy, and Westinghouse. Section 1 of this document describes the PSI Quality Assurance Program and supersedes all earlier PSI Program descriptions or portions thereof. WCAP-8370, Revision 9, Westinghouse Electric Corporation Water Reactor Divisions Quality Assurance Plan describes the quality assurance program of Westinghouse as Designer and Supplier of the Nuclear Steam Supply System. The Sargent and Lundy Quality Assurance Program Topical Report, SL-TR-1A, Revision 5 of October 31, 1977 describes the quality assurance program being implemented by Sargent and Lundy Engineers (S&L) as the architect-engineer. PSI will notify the Nuclear Regulatory Commission of substantial changes to its Quality Assurance Program as described herein, prior to implementation of such changes. PSI shall also notify the NRC of organizational changes which alter the organizations as described herein within thirty days after implementing such changes. Up-to-date programs are available at the respective corporate offices for review and audit.

1. QUALITY ASSURANCE DURING DESIGN, PROCUREMENT AND CONSTRUCTION

1.1 Organization (PSI)

1.1.1 PSI Company Structure

The PSI executive management organization described in the Marble Hill Project Quality Assurance Manual deals specifically with management of quality-related engineering, design, procurement, construction, testing, preoperation, and quality assurance activities associated with nuclear power plants.

The executive management structure is shown in Figure 1-1. The President and Chief Executive Officer is responsible to the Board of Directors for overall management of company operations. He establishes the PSI company policy regarding quality assurance for nuclear plants and has overall responsibility and authority for all aspects of nuclear plant design, construction, operation, and quality assurance. The first major division of responsibility occurs at the vice-president level.

The Vice President-Electric System is responsible for all design, construction, and operations. The Vice President-Electric System, who reports to the Chief Executive Officer, is responsible for the development, implementation, maintenance, and evaluation of the effectiveness of the PSI Quality Assurance Program.

The key positions of the organization are the Project Director, Quality Assurance Manager, Construction Manager, Project Control Manager, Project Engineering Manager, and Project Administrator.
The Project Director will coordinate the varied aspects of the project except for Quality Assurance and will report directly to the Vice President-Electric System. The Quality Assurance Manager directs the Quality Assurance Program and also reports directly to the Vice President-Electric System.

It is Public Service Indiana's intention to name a Chief Operating Officer who will report to the Chief Executive Officer. The PSI Officer who has full authority and responsibility with respect to the Marble Hill Project will report to the Chief Operating Officer when that individual is identified. The Marble Hill Project Director and the Quality Assurance Manager will continue to report to the PSI Officer who has full authority and responsibility for the Marble Hill Project.

The functions of the above positions and their respective organizations as well as those of the Director of Purchasing, are discussed in the following subsections.

1.1.1.1 <u>Director-Purchasing</u>

The Director-Purchasing, who reports to the Senior Vice President Finance, is responsible for control of approved procurement documents and issuance to PSI contractors and suppliers. The responsibilities of the Director Purchasing include preparation of purchase orders for nuclear safety-related materials, equipment and services based on purchase requisitions prepared and reviewed by the Project Engineering Department and reviewed and approved by the Quality Assurance Department.

1.1.1.2 <u>Project Organization</u>

1.1.1.2.1 <u>Project Director</u>

The Project Director reports to the Vice President-Electric System and is delegated responsibility for Marble Hill Station design, construction, project management, and licensing. Reporting to the Project Director are the Project Engineering Manager, the Construction Manager, and the Project Administrator. The Project Director directs and coordinates the work of the NSSS vendor, the architect-engineer, the Project Engineering Manager, the Construction Manager, consultants, and other associated company functions as required to provide a safe, reliable facility. His responsibilities include the implementation and execution of effective design reviews both within the Project Engineering Section and in the architect-engineer's staff, the analysis of bids, purchase recommendations, budgetary analysis, schedule preparation, progress reports, and licensing contacts with the NRC Project Manager. The Project Director will designate appropriate site management personnel to assume his duties in the event of his absence.

1.1.1.2.2 Project Engineering Organization

The Project Engineering function has been reorganized as shown on Figure 1-2 and has been relocated to the site. This new organization provides improved support to the Construction Management organization, improved methods of handling design changes, and additional numbers of people to support the project.

The Project Engineering organization is headed by the Project Engineering Manager who reports to the Project Director. The Project Engineering organization has overall responsibility for coordination of design activities and performs reviews of technical documents as well as assuring that technical reviews are accomplished by other affected PSI organizations. The Project Engineering organization is also responsible for assuring control of design changes and consistency with PSAR/FSAR commitments. The Project Engineering Administrator, who reports to the Project Engineering Manager, is responsible for the control of those design documents prepared by PSI or its Design Contractors, which detail final design and define technical requirements at the Marble Hill site, and for the maintenance of a Document Control Center.

The S&L Engineering organization provides an on-site group from the design organization to review, evaluate, and approve design changes which arise from construction interfaces. This on-site group can be further supplemented by the architect-engineer as the needs arise and is supported by the architect-engineer's staff by normal communications channels.

The Nuclear Design Engineering organization is responsible for the design overview within PSI for the project. This group's responsibilities include interfacing with S&L, and review and approval of design change documents.

The Nuclear Safety and Licensing organization provides licensing support for Project Engineering. This includes preparation and coordination of Safety Analysis Reports, coordinating architect-engineer efforts relative to licensing and acting as the primary contact with the Nuclear Regulatory Commission project management.

The Project Engineering Administration organization develops Project Management Procedures related to Project Engineering, and administers site document control.

The Material Procurement Manager is responsible for coordinating the procurement of permanent plant equipment as well as reviewing Procurement Specifications. He also monitors progress of equipment Suppliers and expedites delivery.

The Special Projects Manager is responsible for resolving generic Engineering problems as they apply to the construction of Marble Hill which arise during the construction of other plants, maintaining a laison organization with the Commonwealth Edison Byron Station, coordinating resources required to solve Engineering problems encountered during construction which cannot be routinely solved by other sections within Project Engineering, and interfaces with the Project Control organization to assure proper input to the control programs with respect to Engineering status.

The Principal Engineer Special Processes is responsible for providing technical assistance in aspects of welding and thermal heat treatment processes for the Marble Hill project.

1.1.1.2.3 Construction Management

The Construction Management organization is headed by the Construction Manager, who reports to the Project Director.

The Construction Management organization has been reorganized as shown on Figure 1-3 to incorporate the area concept of management and contract admministration. This separation of construction management and contract administration allows the construction engineers to devote their efforts to preplan the work with the contractors and identify and resolve potential problems.

The Construction Manager is responsible for the following:

a. Overall responsibility for coordination of the Marble Hill site construction and fabrication.

b. Monitoring Contractor performance to commitments and schedules.

c. Coordination of Contractor interfaces.

d. Direction of the Construction Test program at the site to assure tests required to verify the integrity of the construction work are performed.

e. PSI contractual acceptance of structures and systems from construction Contractors.

The Assistant Construction Manager reports to the Construction Manager. The Assistant Construction Manager directs the Area Construction Managers reporting to him and each is assigned one of these specific areas: turbine building, auxiliary building, reactor building and general facilities.

The Area Construction Managers are responsible for day-to-day coordination of site construction activities within their respective areas. Within their areas, they are also responsible for:

a. Coordination of Construction Contractor access to work areas.

b. Reporting progress to the Assistant Construction Manager.

c. Assuring Contractors take action on nonconformances from specified requirements identified by the Quality Assurance Department or other PSI organizations.

The Resident Field Engineering Group is provided to give support, by discipline to the Area Managers. This group will receive and process contractor change requests and other field generated engineering-related documents, disallow those which are inappropriate, and coordinate the balance with Project Engineering.

The Contract Administration function has been instituted as a part of the Construction Management organization. This function will include: direction of administration, monitoring, and auditing of architect-engineer and Contractor activities for contract performance.

The Systems Turnover Group will manage construction testing, master completion list and system turnover to operations.

The Systems Turnover Manager reports to the Construction Manager and has the following responsibilities:

a. Authorizing issuance and use of construction test procedures prepared by either construction Contractors or PSI.

b. Coordinating construction Contractor participation in the Construction Test Program including test performance, notifications to PSI, and performance of necessary repairs or correction of deficiencies.

c. Coordinating acceptance of completed systems, structures, and components from Construction Contractors following successful completion of applicable construction testing.

d. Coordinating the distribution, review and comment activities of Construction Testing Program documents.

e. Directing and coordinating support personnel and others during performance of Construction Tests including appropriate interface with Station operators.

The Construction Staff Manager will assist the Construction Manager in the administrative functions, such as staff coordination, staff augmentation, contractor prepared procedure review and correspondence control.

The Instrumentation and Control Manager reports to the Construction Manager and is responsible for coordinating instrument and control Contractor's work, and assuring the calibration of station instrument and control equipment prior to turnover to Operations.

1.1.1.2.4 Project Controls

The Project Controls Manager reports to the Project Director and is responsible for developing a system of cost analysis which will allow PSI to effectively control and predict cost of the project. He will develop, with the appropriate organizations and personnel, the overall project Critical Path Method schedule and will input project data to that schedule for updates and amendments.

The Project Controls organization, as shown on Figure 1-4, is comprised of three (3) main sections: Planning/Scheduling/Cost/Estimating, Area Control, and Material Management.

The Project Planning/Scheduling/Cost/Estimating organization is charged with the responsibility of providing project planning, control and cost/management systems.

The Area Control Section is organized by major construction areas, (i.e., auxiliary building, reactor building, turbine building, and general facilities) and is comprised of both cost engineers and construction schedulers. These groups are charged with the responsibility of providing the PSI Area Construction Managers with cost and schedule support.

The Material Management Section has the basic objectives of providing an organization and system to monitor, review, and modify all planned activity on a component or item to make certain that material and equipment is properly stored and maintained. In addition, this section provides material control support to the project.

The Material Management Manager reports to the Project Controls Manager and has the following responsibilities:

a. Assuring storage instructions are obtained for PSI and Contractor-stored items purchased by PSI;

b. Maintaining records of materials, parts and components stored by PSI;

c. Protecting, maintaining and preserving items stored by PSI;

d. Maintaining records of items released by PSI; and

e. Assuring that suppliers and contractors provide prompt disposition and corrective action for nonconformances relating to receipt and storage of items and materials.

1.1.1.2.5 Project Administration

The Project Administration function, as shown on Figure 1-5, provides assistance to the project in the areas of procedural support, facilities support, personnel support and general administrative support.

1.1.1.3 Quality Assurance Organization

The functions of Quality Assurance and Quality Control organizations have been reunited under one department manager and relocated to the site.

The Quality Assurance Manager who reports directly to the Vice President-Electric System is responsible for the Quality Assurance Program. He supervises and provides technical direction to the Quality Assurance Department. The Quality Assurance Department is divided into the Quality Systems Section, the Quality Engineering Section and the Inspection Section as shown in Figure 1-6. All of the PSI Quality Assurance organizations are located at the Marble Hill site. The Quality Assurance Department has unrestricted authority to identify quality problems and to initiate action to cause their correction.

The Quality Assurance Manager has the authority and responsibility to implement the necessary controls to assure that the Marble Hill Project Quality Assurance Program meets all NRC requirements.

1.1.1.3.1 Quality Assurance Manager

The Quality Assurance Manager is responsible for:

a. Managing and directing the Quality Assurance Program.

b. The adequacy of the Quality Assurance Program, interpretation of Quality Assurance requirements and effectiveness of the program's implementation.

c. The use of appropriate techniques to assure conformance of all activities affecting quality to the program's requirements.

d. Assuring the adequacy, clarity and appropriateness of all PSI Quality Assurance oriented communications and commitments directed to Regulatory Agencies, Contractors and Suppliers.

e. Assuring that actions such as Quality Assurance Program review, surveillance and audits are taken to require Contractors and Suppliers to comply with applicable Quality Assurance commitments.

f. Appropriately exercising the authority vested in the Quality Assurance Organization to cause the acceptance or rejection of work, materials and equipment based on conformance to engineering requirements or failure to meet procurement requirements.

g. Apprising the Vice President-Electric System and Project Director of the project quality status by periodic reporting on quality activities, trends and problems through implementation of a corrective action system.

h. Coordinating applicable activities of Regulatory Agencies such as audits, inspections or investigations with the affected organization manager(s).

i. Appropriately exercising authority to stop nonconforming work.

j. Developing and maintaining current the PSI Project and ASME Quality Assurance Programs and Manuals (PQAM and AQAM).

k. Maintaining a staff of a sufficient size and qualification to support required audit, surveillance and program development activities.

l. Contacting the NRC on Quality Assurance matters.

1.1.1.3.2 Quality Systems Organization

The Quality Systems Section is responsible for:

a. Development, preparation, implementation, and maintenance of the PSI Quality Assurance Manuals and development of related Project Management Procedures.

b. Development of Chapter 17 of the Safety Analysis Report.

c. Training of PSI personnel in quality assurance concepts and methods.

d. Maintaining the program of Certification of PSI inspectors and auditors.

e. Scheduling, planning and coordinating PSI audits of the Architect-Engineer, the NSSS Supplier, PSI Contractors and internal audits of PSI organizations.

f. Follow-up action as the result of audit findings.

g. Reviewing and maintaining quality assurance records at the Marble Hill Project Site.

h. The tracking and trending of nonconformances.

The Quality Assurance Operations Group reports to the Superintendent-Quality Systems. It is responsible for the quality assurance of preoperational and startup testing and operations activities and maintenance of the Quality Assurance Records associated with the preoperational and startup testing and commercial operation. This is accomplished by the review of procedures and records, the witnessing of selected test points, and the surveillance of testing activities. It is planned at a later point, that this group will report directly to the PSI Quality Assurance Manager.

1.1.1.3.3 Quality Engineering Organization

The Manager of Quality Engineering reports to the Quality Assurance Manager and is responsible for:.

a. Supervising and directing Quality Engineering Superintendents in the Civil, Mechanical, Electrical, Welding, Nondestructive Examination disciplines, and the Superintendent of Procurement Quality Assurance.

b. Maintaining communication and coordination between the various discipline Superintendents Quality Engineering and other PSI and Contractor organizations for Quality Assurance matters within the responsibilities of the Quality Engineering Section.

The Quality Engineering Section is responsible for:

a. Reviewing quality requirements.

b. Evaluating changes to the and other major contracto

c. Identifying characteristic

d. Prescribing verification m

e. Preparing PSI surveillance

f. Identifying documentation me

g. Assuring adequate definition through review and comment on

h. Approving dispositions of nonc identified by suppliers and co "use-as-is" or "repair".

i. Verifying the causes of noncont corrective action.

j. Reviewing and approving PSI gene

k. Maintaining an approved supplier

l. Reviewing supplier/contractor qua corrective action.

1.1.1.3.4 Inspection Organization

Using surveillance plans and inspection check Engineering, the Superintendent Inspection is

a. Source surveillance of safety-relate supplier's facilities.

b. Receipt inspection of PSI procured sa the construction site.

c. Surveillance and inspection of contrac construction activities at the job site

d. Documenting inspection and surveillance conditions.

e. Stopping further processing of unaccepta

f. Controlling subsequent processing of mate through PSI inspection and surveillance.

g. Establishing and maintaining control of PS equipment during construction.

The PSI Quality Assurance Department is assigned responsibility for checking, auditing, inspecting, or otherwise verifying that quality-related activities are correctly performed. As shown on Figure 1-6, the Quality Assurance Department is directed by the Quality Assurance Manager. He is the individual responsible for managing the PSI Quality Assurance Program and for directing and controlling the PSI's conformance to quality requirements. The Project Quality Assurance Manual (PQAM) designates specific quality assurance functions to be accomplished by the Quality Assurance Department and thereby, delegates corporate authority for performance of these functions. Specific quality assurance functions include:

a. identifying quality problems;

b. initiating, recommending, or providing solutions; and

c. verifying implementation of solutions

The PSI executive management structure (Figure 1-1) is such that the Quality Assurance Manager reports to the Vice President-Electric System. This reporting level is the same as that of the highest line manager directly responsible for performance of quality-affecting activities (The Project Director, Vice President-Engineering, Vice President-Construction, and the Vice President-Power). The Quality Assurance Department is, therefore, independent of undue influences and responsibilities for schedules and costs and has sufficient organizational freedom to perform quality assurance functions. The reporting structure also affords direct quality assurance access to PSI executive management, which assures the availability of support as required to carry out quality assurance responsibilities.

The Quality Assurance organization has full authority to stop further processing of items or materials by PSI, its suppliers or contractors which are not being performed in accordance with applicable specifications, drawings, or standards. In addition, the Quality Assurance Manager has the authority to stop all of the contractor's work if deemed necessary, to obtain corrective action relative to quality performance.

The minimum qualification requirements for the Quality Assurance Manager position are as specified in Subsection 1.2.6.

1.1.1.4 Licensing Department

The PSI Licensing Manager reports to the Vice President-Electric System, and is responsible for the review of licensing material prior to transmittal to the regulatory agencies. He is also responsible for analyzing current licensing trends and will advise the Project Director as to possible effects on the licensing of the Marble Hill Station.

1.1.1.5 Nuclear Fuels Organization

The Nuclear Fuel Section is directed by the Manager-Nuclear Fuel, who reports to the Vice President-Power, and is responsible for fuel procurement, enrichment, fuel fabrication, and fuel cycle data analysis.

1.1.1.6 Nuclear Operations Organization

The Nuclear Operations Manager who reports to the Director Power Production, is responsible for the review of the Technical Specifications, selection and training of plant personnel, and the review of the preoperational and startup tests as well as providing equipment and operating personnel for those tests. He is also responsible for inservice inspection, operation, maintenance, repair, and refueling of the Marble Hill Station. The Marble Hill Station Staff is directed by the Marble Hill Station Manager.

The function of these groups is further described in Chapter 13.0 of the Safety Analysis Report for the Marble Hill Project. The Nuclear Operations Manager is the Engineer in charge as described in ANSI N18.1.

Individuals and groups within PSI maintain open and direct communications with the principal contractors for the Marble Hill Project. Communications with the principal contractors' quality assurance organizations will be directed through, but not limited to, each organization's project manager for the Marble Hill Nuclear Project. The principal contractors' project managers shall ensure sufficient, direct communications between each organization's quality assurance sections to adequately resolve any quality assurance problems.

1.1.1.7 Staffing

PSI's approach to increasing experience level of the project management and Quality Assurance staffs is as follows:

a. Reassignment of Personnel

Quality Assurance personnel experience has been reviewed against required training and experience levels needed for qualification; only persons qualified in accordance with ANSI N45.2.6 will be placed in those positions performing verification of quality. In functions not covered by ANSI N45.2.6, PSI has reviewed personnel qualifications and has reassigned personnel to positions commensurate with their experience. Where appropriate, other personnel will be trained to qualify for positions in the overall Marble Hill organization or reassigned to other positions within PSI.

b. Hiring of New PSI Personnel

Recruiting of additional personnel is being accomplished through the use of personnel placement services, PSI personnel recruiters, executive search firms and media advertisements.

c. Use of Contract Personnel

PSI has upgraded its current level of experience through the use of contract personnel. Selected positions have been staffed with qualified Management Analysis Corporation (MAC) personnel who are managing certain key functions and the recruiting, hiring, and training of qualified PSI counterparts. The key positions in project management and Quality Assurance are being staffed with qualified MAC and PSI employees.

It is planned that during the term of MAC's involvement on the project, the PSI counterpart in each of these positions will be indoctrinated to assume the project responsibilities. Specific plans for implementing this transition will be developed. The NRC and ANI will be notified prior to release of such contract personnel at supervisory levels.

Contract personnel will be used in other areas of the project to supplement existing staff as needed.

d. Description of Planning For Adequate Inspection Staffing

The ability to perform timely inspections is a direct function of the availability of inspectors. Work to be done can be matched with available inspection manpower resources on both a short and long term basis.

For short term inspection planning, specific work packages consisting of discrete schedulable activities shall be developed by Project Control and evaluated by Quality Assurance for inspection manpower requirements. Construction schedules shall be revised to make optimum use of available human and equipment resources. Construction work shall not be scheduled beyond the capability to verify quality. Effectiveness of the program will be assured by Quality Assurance participation in the work planning, by PSI surveillance and audit, and by the enhanced authority of the PSI Inspectors and Quality Assurance Manager to stop processes where it appears that quality may be jeopardized.

Long term matching of inspection resources with work will be accomplished by Quality Assurance review of projected work forces of PSI and its contractors. This review will permit recruiting and training activities to be carried out in such a manner as to provide trained Quality Assurance personnel necessary to assure the quality of the work.

As a part of the revised PSI Quality Assurance Program, inspectors shall be provided with approved inspection procedures, instructions, and checklists prior to performing inspection operations. These documents shall contain identification of characteristics to be inspected, identification of personnel or groups performing the inspection, a description of the method of inspection, accept/reject criteria, verification of completion of inspection, and a record of the results of the inspections.

To further assure that inspections are done in a timely manner, PSI will identify specific hold points be established in the contractor's planning and make provisions for notification on "hold" points. This program, coupled with having the work effort managed on an "area" basis, with inspectors assigned to each area, will assure timely inspections.

1.1.2 Delegation of Quality Assurance Authority

PSI requires each contracting organization performing activities affecting quality to have an adequate and implemented quality assurance program complying with the applicable criteria of 10 CFR 50, Appendix B. Specific quality assurance requirements are incorporated into contract documents or purchase orders, and principal contractor quality assurance plans, procedures, and instructions are reviewed and approved by PSI to assure compliance with contract requirements.

PSI has taken the position that each contracting organization performing work affecting quality on the Marble Hill project shall be responsible for establishing, implementing, and monitoring its own quality assurance program. Subsequent to acceptance of principal contractors' written plans, procedures, and instructions, PSI assures proper implementation and verifies the effectiveness of the quality assurance programs through comprehensive audits and surveillance of facilities, activities and records. The principal contractors as used in this section are the architect-engineer and NSSS supplier.

The principal contractors participating in the design and construction of the Marble Hill Station who have been delegated Quality Assurance functions are:

a. Sargent & Lundy - architect-engineer.

b. Westinghouse Electric Corporation, Nuclear Energy Systems (NES) - designer and supplier of the nuclear steam supply system and nuclear fuel.

Sargent & Lundy provides architect-engineering services for the Marble Hill Station. These services include:

a. Overall design of the station, integrating the nuclear steam supply systems and turbine generators with the complete balance-of-plant items.

b. Responsibility for identification and coordination of design interfaces among the principal contractors.

c. Procurement services for balance-of-plant items and construction services and preparing of procurement specifications, analyzing proposals and making purchase recommendations, reviewing supplier QA programs and implementing procedures.

d. Performing source inspection of material and equipment of supplier of balance-of-plant safety-related items and Westinghouse NES Manufacturing Divisions as requested by PSI.

Westinghouse Electric Corporation provides the Nuclear Steam Supply System and nuclear fuel, and is responsible for performing all design, procurement, fabrication, and quality assurance activities associated with their scope of supply.

1.2 Quality Assurance Program (PSI)

1.2.1. Program Compliance

PSI requires that the design, procurement, construction, and instal station be carried out in accordance with 10 CFR 50, Appendix B. Th Assurance Program for the Marble Hill Project is described in two Assurance Manuals. Each relates directly to the eighteen criteri by 10 CFR 50, Appendix B, for Quality Assurance Programs for Nucl Plants. One manual has been prepared in relation to Public Servi responsibilities as Owner of the Marble Hill facility. The othe arranged directly to requirements of an N-Certificate Holder for of Section III, Division 1 of the ASME Boiler and Pressure Vess manuals are implemented through Project Management Procedures additional detail is required. Changes to either manual are c assure that basic requirements and methodology are functionin Tables 1-1 and 1-2 designate the Project Quality Assurance Ma sections and PSI Project Management Procedures which provide each 10 CFR 50, Appendix B, criterion.

Design of Marble Hill Units 1 and 2 replicates to the maxi the design of Commonwealth Edison Company Byron Station de concept does not affect the PSI quality assurance policy t activities needed to provide assurance that quality objec during design and procurement.

The PSI Quality Assurance Program complies with the app established in the following publications:

a. Guidance on Quality Assurance Requirements D Procurement Phase of Nuclear Power Plants (

b. Guidance on Quality Assurance Requirements Phase of Nuclear Power Plants (Green Book)

c. NRC regulatory guides which provide guid implementing portions of the QA Program.

d. NRC Policy and Procedures for the Repli - July 1974.

PSI requires that its principal contractors com and other published guidelines from the Nuclear apply to activities affecting quality. The PS is responsible for verifying compliance with t

For replicate items, the Quality Assurance Pl Byron Station by the base plant owner, Sarge formulating and verifying the design, design specifications of the base plant items are considered ade requirements for replicated structures, sy

1.2.2 Program Applicability

The CC-ME-01-MH, "Classification Criteria of Structures Systems and Components" identifies the safety-related structures, systems, and components to be governed by the PSI Quality Assurance Program. Through reviews performed by Project Engineering and Quality Assurance, PSI assures that such items are properly classified as to Safety, ASME Code, Seismic Category and Electrical Classification. CC-ME-01-MH includes references to Reg. Guides 1.26 and 1.29. It is a controlled document requiring approval of the PSI Project Director, the PSI Project Engineer and the PSI Quality Assurance Manager. This listing is subject to revision. Changes require equivalent approvals to the original. The issue current as of the date of submittal of this document is included as Appendix A.

1.2.3 Program Development and Implementation

PSI began the development and implementation of a Quality Assurance Program in March, 1974, when PSI established a corporate commitment to quality assurance. The following policy statement is formally issued with the PSI Project Quality Assurance Manual:

> The Public Service Company of Indiana policy is to ensure the highest feasible degree of functional integrity and reliability of those systems, equipment, and structures of its nuclear power generating stations that are essential to the prevention of nuclear incidents which could affect adversely the health and safety of the public and PSI employees or to the mitigation of the consequences of such incidents in the unlikely event they should occur.
>
> The Vice President-Electric System is assigned the authority and responsibility within PSI for all activities associated with the design, procurement, construction, startup, operation, maintenance, and quality assurance of the Marble Hill Project. To ensure that all of these activities are performed in a manner consistent with the policy set forth in this Manual, the Company has established a Quality Assurance Program to meet the requirements of 10 CFR 50, Appendix B. The Quality Assurance Manager has been delegated responsibility for the implementation and maintenance of the Program as well as evaluating its effectiveness.
>
> All personnel performing duties affecting quality including PSI employees as well as those of its contractors, suppliers, and any other organization performing quality activities associated with the nuclear project are responsible for compliance with the directives established within the Quality Assurance Program. Each individual shall be familiar with the policies, requirements and procedures set forth in the Quality Assurance Program and shall implement those elements of the Program for which he is responsible.
>
> All personnel performing Quality Assurance functions are responsible for and have the authority and organizational freedom to identify quality problems; initiate, recommend or provide solutions; verify implementation of solutions, and limit or control further processing or installation of an

item until proper dispositioning of the nonconformances or unsatisfactory condition has occurred.

Any conflicts that cannot be resolved within the requirements of the Manual shall be brought to the attention of the Vice President-Electric System for final resolution. All resolutions shall meet the requirements of 10 CFR 50, Appendix B.

The policy statement is signed by the Company President. In addition to the formulation of quality assurance policy, PSI has established the following quality assurance objectives:

PSI Quality Assurance Objectives

PSI has established the folowing goals and objectives related to Quality Assurance:

a. PSI will establish and implement an effective Quality Assurance Program.

b. PSI shall assure the established Quality Assurance Program complies with regulatory commitments.

c. The scope of the Quality Assurance Program shall include all applicable activities which may affect the quaslity of nuclear safety-related materials, items, or services.

Further, the Company's objective is to comply with the applicable quality control criteria, guides, codes, and standards. Specifically, PSI intends to achieve this goal through compliance with the following as interpreted and understood by PSI:

Quality Assurance Program Commitments to Regulatory Guides and Endorsed Codes and Standards

NRC Regulations and Guides:

Appendix B to 10 CFR Part 50, 'Quality Assurance Criteria for Nuclear Plants'.

'Guidance on Quality Assurance Requirements During Design and Procurement Phase of Nuclear Power Plants' (Gray Book).

'Guidance on Quality Assurance Requirements During the Construction Phase of Nuclear Power Plants' (Green Book).

'Guidance on Quality Assurance Requirements During the Operations Phase of Nuclear Power Plants' (Orange Book).

'NRC Policy and Procedures for Replication of Custom Plant Designs' - July 1974.

'NRC Guidelines for Quality Assurance Controls for Fire Protection, BTP ASB 9.5.1 Position C Quality Assurance Program'.

Industry Standards and Associated Regulatory Guides:

REGULATORY GUIDE		ENDORSED STANDARD
1.28	"Quality Assurance Program Requirements (Design and Construction)" (Rev.0, 6/7/72)	ANSI N45.2-1971
1.30	"Quality Assurance Requirements for the Installation, Inspection, and Testing of Instrumentation and Electric Equipment" (8/11/72)	ANSI N45.2.4-1971
1.37	"Quality Assurance Requirements for Cleaning of Fluid Systems and Associated Components of Water-Cooled Nuclear Power Plants" (3/16/73)	ANSI N45.2.1-1973
1.38	"Quality Assurance Requirements for Packaging, Shipping, Receiving, Storage, and Handling of Items for Water-Cooled Nuclear Power Plants" (3/16/73)	ANSI N45.2.2-1972
1.39	"Housekeeping Requirements for Water-Cooled Nuclear Power Plants" (3/16/73)	ANSI N45.2.3-1973
1.54	"Quality Assurance Requirements for Protective Coatings Applied to Water-Cooled Nuclear Power Plants" (6/73)	ANSI N101.4-1972
1.58	"Qualification of Nuclear Power Plant Inspection, Examination, and Testing Personnel" (8/73)	ANSI N45.2.6-1973
1.64	"Quality Assurance Requirements for the Design of Nuclear Power Plants" (10/73)	ANSI N45.2.11 Draft 3, Rev. 1
1.74	"Quality Assurance Terms and Definitions" (2/74)	ANSI N45.2.10-1973
1.88	"Collection, Storage, and Maintenance of Nuclear Power Plant Quality Assurance Records" (8/74)	ANSI N45.2.9-1974
	"Quality Assurance Requirements for Installation, Inspection, and Testing of Structural Concrete and Structural Steel During the Construction Phase of Nuclear Power Plants" (From WASH-1309, 5/10/74) Draft 3, Rev.1	ANSI N45.2.5-1974

"Quality Assurance Requirements for Installation, Inspection, and Testing of Mechanical Equipment and Systems" (From WASH-1309, 5/10/74)	ANSI N45.2.8-1974 Draft 3, Rev.3
"Quality Assurance Requirements for Control of Procurement of Items and services for Nuclear Power Plants" (From WASH-1309, 5/10/74)	ANSI N45.2.13-1974, Draft 2, Rev.4
"Guidance on Quality Assurance Requirements During Design and Procurement for Auditing of Quality Assurance Programs for Nuclear Power Plants" (From WASH-1283, 5/74)	ANSI N45.2.12-1974, Draft 3, Rev.4

CODE COMMITMENT

ASME Boiler and Pressure Vessel Code, Section III, Division 1

Note: At the time of submittal of the PSAR, four of these standards were in draft form. For future work instead of the drafts, PSI will meet the intent of the approved standards in place of these drafts, endorsed by regulating guides current as of the date of this document. Included are:

Regulatory Guide 1.94, Rev. 1; "Quality Assurance Requirements for Installation and Testing of Structural Concrete and Structural Steel During the Construction Phase of Nuclear Power Plants", and ANSI N45.2.5-1974.

Regulatory Guide 1.116, Rev. 0-R, "Quality Assurance Requirements for Installation, Inspection and Testing of Mechanical Equipment and Systems" and ANSI N45.2.8.

PSI will also meet the intent of ANSI N45.2.23, "Qualification of Quality Assurance Program Audit Personnel for Nuclear Power Plants" in qualification of its auditors as described in Section 17 of this report.

The PSI quality assurance policy and objectives were promulgated in written form and utilized as the basis for development of Project Quality Assurance Manual and implementing Procedures as well as performance of initial quality-related activities. The corporate quality assurance policy preface each copy of the Project Quality Assurance Manual originally issued October 7, 1974, and revised January 22, 1980. The Project Quality Assurance Manual has been distributed to all levels of management and all organizations concerned with quality-related activities for the Marble Hill Project.

Activities affecting quality initiated prior to the submission of the PSAR include:

a. selections of architect-engineer, NSSS supplier, and fuel manufacturer (initial core and first reload);

b. development of the PSAR;

c. establishment of design basis criteria; and

d. meteorological, geotechnical, and geological site surveys.

Prior to October 7, 1974, these activities were surveyed for compliance with 10 CFR 50, Appendix B, and Gray Book requirements. After October 7, 1974, all quality-related activities were controlled utilizing the provisions of the Quality Assurance Program Manual. Prior to the issuance of the Quality Assurance Program Manual, the quality of the activities performed was verified to be in conformance with the requirements of 10 CFR 50, Appendix B and the Gray Book by review and audit. This included:

a. reviewing the audits, surveillance, and quality assurance programs of contractors conducting quality-related activities.

b. reviewing prospective principal contractors' quality assurance program descriptions for adequacy and compliance with pertinent regulations, standards and guidelines.

c. auditing of on-going quality-related activities based on draft quality assurance procedures and experience with assistance provided by a consultant.

The PSI Quality Assurance Program Manual content was initially defined utilizing the projected PSI scope of involvement in project quality-affecting activities. All drafts of the Quality Assurance Program Manual and procedures were reviewed by PSI corporate managers, project personnel, and quality assurance personnel to assure consistency with PSI policies and objectives.

The Project Quality Assurance Manual was reviewed and approved by the Vice President-Electric System prior to issuance. The distribution of the Project Quality Assurance Manuals is controlled by assigning unique copy numbers to each manual and requiring written acknowledgement of receipt by receiving organizations. Changes to manuals require the prior approval of the Quality Assurance Manager, the Project Director and the Vice President-Electric System. Changes to Project Management Procedures require approval by the Quality Assurance Manager and the Project Director. If the requested Quality Program change requires a SAR amendment, the Quality Systems Section is responsible for drafting the proposed amendment. Project Management Procedures will describe the review, approval and distribution controls for SAR amendments.

PSI requires that all principal contractors have an implemented quality assurance program that satisfies the requirements of 10 CFR 50, Appendix B. PSI annually reviews and approves the quality assurance programs of its principal contractors and contractors providing items or services purchased by PSI. PSI requires that its principal contractors and contractors review and approve the quality assurance programs of their subcontractors and pass on applicable quality assurance requirements to subtiers.

1.2.4 Program Documentation

The PSI Quality Assurance Program is described by the
Assurance Manual and the ASME Quality Assurance Manua
PSI Project Management Procedures. The Project Qual
the PSI organizational structure as it relates to qu
the functions, duties, and responsibilities of key d
describes interrelationships and interfaces among i
organizations; delineates Program requirements; and
implementation.

The Project Management Procedures provide detailed
of the Program requirements and methods addressed
Assurance Manual and the ASME Quality Assurance M

Table 1-2 provides a listing of the Project Mana
is divided into categories covering the major qu
project management, design control, procurement
management, and construction testing. This lis
Management Procedures which comply with each 10

1.2.4.1 Description of PSI ASME Code Program

The PSI Project Quality Assurance Manual has b
responsibilities as an Owner as defined by th
non-ASME Code activities for safety-related c

The PSI ASME Quality Assurance Program has b
responsibilities as an N-Certificate holder
Code requirements and to ensure achievement
functional integrity of piping systems. Th
January 2, 1980 and became effective for i
interim letter of authorization has been i

In addition, the concerns raised by the Na
Vessel Boards have been addressed.

a. General Responsibilities of PS

1. The Project Quality Assur
as an Owner under the ap
Code.

2. PSI has obtained an Own
required by the ASME Co

3. PSI will certify and f
NCA 3270 of the ASME C

4. PSI or its designee w
requirements are des

5. PSI has obtained a written agreement with an Authorized Inspection Agency.

6. Preparation of Design Specifications is performed by PSI or its Design Subcontractor. The Design Specifications are reviewed by the PSI Project Engineering Manager to assure that ASME Code requirements are met. The Design Specifications are certified by PSI or its designee in accordance with ASME Code requirements.

7. Review and release of Design Specifications is performed by PSI Project Engineering and Quality Assurance to assure inclusion of ASME Code requirements.

8. Review of component manufacturers' Quality Assurance Programs and ASME Code authorizations is performed by PSI Quality Assurance.

9. Periodic surveillance at the component manufacturers' facilities is performed by PSI Quality Assurance to determine compliance with their approved ASME Quality Assurance Programs.

10. PSI Project Engineering reviews technical changes to the Design Specification to assure compliance with ASME Code.

11. PSI Project Engineering or its qualified Design Subcontractor reviews and certifies the review of Component Design Reports.

12. Physical receipt inspection and review of documentation is performed by PSI Quality Assurance upon delivery of the component to the project site.

b. General Responsibilities of PSI as an N-Certificate Holder

1. The Quality Assurance Manager, under authority from the Vice President-Electric System, has been delegated responsibility and authority for implementation and maintenance of the ASME Quality Assurance Program as well as evaluating its effectiveness.

2. The PSI Project Engineering Manager is responsible for design activities associated with the Marble Hill Project.

3. Sargent & Lundy Engineers have been retained by PSI as the Design Subcontractor for all ASME Code piping systems except for reactor coolant piping systems for the Marble Hill Project.

4. Westinghouse has been selected by PSI as the Design Subcontractor for reactor coolant piping systems.

5. The Design Subcontractors are responsible for:

   i. Reviewing the requirements of the Certified Design Specifications.

ii. Performing stress analysis calculations.

iii. Preparing drawings and specifications.

iv. Preparing Design Reports or Load Capacity Data Sheets as applicable.

v. Certification of the Design Report or Load Capacity Data Sheet, when required by the Code.

vi. Reconciliation of changes to specifications and drawings with the Design Report.

vii. Assuring that applicable requirements of the Certified Design Specification and of the Code are correctly translated into specifications and drawings.

a. PSI's Technical Responsibility for Design Efforts (N-Certificate Holder)

1. The Project Engineering Manager reviews the Owner's Certified Design Specifications.

2. The Project Engineering Manager subcontracts design work to the Design Subcontractors in accordance with the ASME Quality Assurance Program. The Design Subcontractors prepare and certify the Design Reports.

3. The Project Engineering Manager reviews the Design Reports to assure that they conform to applicable Code requirements and the Owner's Certified Design Specifications.

4. The Design Subcontractors provide PSI with engineering and construction drawings for piping systems. The drawings are reviewed by PSI Project Engineering.

5. Engineering and technical documents are controlled in accordance with the document control provisions of the ASME Quality Assurance Program.

d. Acquisition of "N" Stamp

1. PSI will arrange for an ASME implementation survey of the Marble Hill Project timed so that the survey will start the same date the NRC Confirming Order is lifted with respect to Code work on piping systems.

2. To assure that the program for Code activities progresses satisfactorily and is being implemented properly, the following actions are being taken:

3. PSI has retained an independent consultant (NUTECH) to:

i. Provide development of training programs for PSI personnel on Code requirements and the ASME Quality Assurance Program.

ii. Provide assistance to PSI in developing detailed implementing procedures.

iii. Perform periodic reviews at the job site to assure that the program is being properly implemented.

iv. Perform an audit of Code activities by PSI shortly after commencement of Code activities.

1.2.5 Quality Assurance Training

1.2.5.1 Project Training

An integral part of the PSI Quality Assurance Program is its provision for the training and indoctrination of project personnel and quality assurance personnel in the techniques of quality assurance. The training program is established under the administrative supervision of the Vice President-Electric System. Implementation of the training program is the responsibility of the Project Training Manager.

The training program applies to all PSI personnel who perform project-related activities affecting quality. Participation in the program is mandatory. The selection of participants and the degree of required participation is determined by the responsible Section Manager. The training program is conducted through the use of the following techniques:

a. lectures,

b. seminars,

c. demonstrations,

d. industry committee participation,

e. workshops, and

f. field trips.

PSI is developing a comprehensive training program. This program is intended to supplement the technical expertise of project personnel in specific areas, to provide familiarization in project procedures, and to indoctrinate project personnel in site rules. The program will also provide documentation of training.

PSI now has an on-site Training Manager. The Training Manager reports directly to the Project Personnel Director who reports to the Vice President-Electric System. The Training Manager is also supported

by an educator on contract to PSI for assistance in the development of the training program. It is anticipated that the training function will be reassigned to Project Administration at a future date.

The first level of training will consist of indoctrination for all site personnel. This aspect of the program will cover such typical topics as:

a. Importance of Quality.

b. Nonrecrimination aspects of reporting.

The second level of training will consist of training and indoctrination for PSI project and Quality Assurance personnel. This portion of the training program will include the following:

a. Teaching programs for individuals who will instruct other project individuals.

b. Indoctrination in Project Management Procedures.

c. Indoctrination in the PSI Quality Assurance Program.

The third level of training will consist of job specific training for appropriate groups within the project. This portion of the training program will include the following typical topics:

a. Construction practices.

b. Quality Assurance inspection procedures.

c. ASME Code requirements.

This training program will be updated periodically as the project proceeds to meet specific needs which have been identified. Training in some areas, such as Quality Assurance inspection procedures, has begun. The training necessary to support specific activities will be in-place prior to the start of those activities.

1.2.5.2 Quality Assurance Training

The Quality Assurance Manager is responsible for the quality assurance training and indoctrination program. His responsibilities include the development and approval of the training program outlines, lesson plans, and schedules. The quality assurance training program is divided into three separate areas:

a. training of quality assurance staff,

b. training of project personnel, and

c. indoctrination of executive management personnel.

All personnel responsible for performing quality related activities are instructed as to the purpose, scope, and implementation of the Project Quality Assurance Manual and Procedures.

The training of the quality assurance staff is structured to provide the details and instructions necessary to perform the activities required of the staff, such as reviewing documents, surveillance of activities, audits, and record retention.

The training of project personnel is structured to provide necessary background in quality assurance and instructions regarding their performance of activities affecting quality, including document development, verification, and retention.

The quality assurance training program is implemented through a PSI Project Management Procedure which formalizes the training program, details and responsibilities, and provides for documentation attendant to the program.

PSI requires that its principal contractors and subcontractors have an effective training program and that they provide documented evidence of the training conducted.

PSI has used, and will probably continue to use, contract personnel for interim periods to augment its staff with qualified personnel with nuclear experience and to assist in training its on-site staff. Such contract personnel shall meet qualification requirements for positions assigned. Contract personnel will be displaced as qualified personnel are hired by PSI to requisite staffing levels.

1.2.5.3 Description of System of Indoctrination

PSI will implement indoctrination of its site personnel as a part of the training program described in Sections 1.2.5.1 and 1.2.5.2 above. Additionally, PSI will provide material to the contractors, who will indoctrinate craft personnel as they are assigned to the project.

1.2.5.3.1 Content

An audio-visual presentation is currently being produced to be presented to construction personnel. This presentation will be used as an orientation program for new construction personnel and is designed to address the uniqueness of building a nuclear power plant. The presentation strongly emphasizes the need for quality work and further addresses the issue of reporting without recrimination. This presentation was made available for use about March 1980.

Indoctrination for site personnel will include the requirements of 10 CFR 21. In addition to the posters required by 10 CFR 21, each employee is given a handbook, outlining the provisions of 10 CFR 21, for personal reference. This booklet stresses that recrimination is not associated with any such reporting.

1.2.5.3.2 Implementation

The indoctrination program is being developed in modular form. This program will be presented to current employees and to each new employee upon arrival at the job site.

1.2.5.3.3 Records

Records will be maintained identifying each employees' participation in the indoctrination program.

1.2.5.3.4 Other

In addition to the above, PSI is developing posters and other materials that will be prominently displayed on the job site as a reminder of PSI's concern and commitment to quality and its policy of no recrimination for reporting.

1.2.6 Personnel Qualification

To ensure that the PSI Quality Assurance Manager is able to perform his duties adequately, a set of minimum qualification requirements has been designated as follows:

Quality Assurance Manager:

The Quality Assurance Manager shall have a broad background and working knowledge of power plant construction, operation and maintenance. In addition, the Manager shall have the ability to establish internal and external channels of communication to successfully achieve company goals and objectives. Educational requirements include as a minimum, a baccalaureate degree in engineering or science plus a minimum of five years experience in a responsible position in engineering or quality assurance, or high school diploma plus a minimum of fifteen years in engineering or technical activities, at least five of which must be in quality assurance or quality control. Two years of the experience should be associated with nuclear facilities.

1.2.7 Control of Activities

The PSI Quality Assurance Program requires that all quality-related activities be conducted using approved procedures. These procedures specify the necessary conditions, appropriate equipment, suitable environment, and necessary prerequisites for conducting activities.

PSI requires that its principal contractors exercise the same type of controls over all of their quality-related activities.

PSI QA responsibilities under the Quality Assurance Program include the following:

a. reviewing safety-related design base criteria documents;

b. reviewing non-replicate design output documents; changes to replicate design documents and replicate documents relating to significant licensing issues, complex interfaces, new regulatory requirements and product experience;

c. preparing quality assurance specifications for principal contractors;

d. evaluating non-replicate procurement specifications, and changes from replication in replicate specifications;

e. conducting pre-award surveys of prospective contractors, as appropriate;

f. reviewing proposals from prospective contractors;

g. reviewing and approving contractor quality assurance programs against the requirements of 10 CFR 50, Appendix B;

h. conducting surveillance of construction contractors;

i. conducting system and structure quality verification record review;

j. conducting surveillance of preoperational and startup testing activities;

k. performing internal PSI audits and external audits of principal contractors and selected subcontractors;

l. approve control deviations and nonconformance dispositions;

m. monitoring and performing trend analysis of deviation and nonconformance control measures;

n. training and indoctrinating personnel performing quality-related activities;

o. controlling and maintaining the Project and ASME Quality Assurance Manual and Project Management Procedures; and

p. retaining and filing quality verification documents.

Resolution of differences of opinion between QA personnel and other department or organization personnel is accomplished through discussion and mutual agreement between participants, culminating at the Vice President-Electric System. PSI will provide notification to the NRC prior to any substantive changes to the PSI and NRC approved Quality Program Description and will notify the NRC of significant changes in organization structure as related to the Marble Hill Project within thirty days of their announcement.

1.2.8 Management Review

The Vice President-Electric System is responsible for reviewing and evaluating the status and effectiveness of the PSI Quality Assurance Program. The primary elements of management participation are by review of Quality Assurance reports, and establishment of a Quality Assurance Review Committee. This committee is chaired by the Vice President-Electric System and includes six other Company Officers, the Project Director, the Licensing Manager, the Quality Assurance Manager, and the Director of Purchasing who reports to the Senior Vice President-Finance. The Committee meets at least every two months, reviews reports and evaluates actions relative to significant events. An annual

independent audit shall be performed at the direction of the Vice President-Electric System which assesses the scope, implementation, and effectiveness of the Quality Assurance Program to assure that the program is meaningful, effectively complies with applicable codes, standards and regulatory guides and effectively implements all elements of the Quality Assurance Program as stated in the PQAM. Reports containing the results of the audit shall be reviewed and appropriate action taken as directed by the Vice President-Electric System.

Quality Assurance programs of principal contractors are also evaluated and monitored. Prospective principal contractors were qualified by evaluation of historical quality data and/or conduct of quality assurance surveys (audits) by PSI personnel. Subsequent to contract award, PSI initiates planned and periodic audits of principal contractors' facilities, records, and activities to assure implementation of, and compliance with, documented plans and procedures. All of the review, evaluation and auditing activities are prescribed by PSI Project Management Procedures.

1.3 Design Control (PSI)

1.3.1 Regulatory Requirements and Standards

PSI has delegated primary responsibility for development of design base criteria (including regulatory requirements, design bases, and quality standards) to Sargent & Lundy (S&L) and Westinghouse. Design of Marble Hill Units 1 and 2 replicate to the maximum extent practicable, the design of Commonwealth Edison Company Byron Station. The replication concept does not affect the PSI QA policy to control those activities necessary to assure that quality objectives are achieved during design and procurement. PSI project and quality assurance organizations review and approve classification of structures, systems, and components assigned by S&L and Westinghouse. Approval of classification of Westinghouse supplied equipment shall be made against ANSI N18.2-1973. Subsequent to approval of structure, system, and component classifications, PSI reviews and approves non-replicate design base criteria and any necessary changes to replicate design base criteria developed by S&L and Westinghouse for safety-related items.

The design process, that of translating applicable design base criteria into specifications, drawings, procedures, and instructions, is the prime responsibility of S&L and Westinghouse. Design of Marble Hill Units 1 and 2 is based upon duplicating to the maximum extent practicable, the Byron Station design. Replicate designs may be modified because of unique site related features, economic considerations, licensing requirements, and reliability improvements. The S&L and Westinghouse design control program for Marble Hill is devised to handle both replicate and non-replicate design documents. The PSI internal design review system is devised to handle both replicate and non-replicate design specifications and drawings. PSI shall review design procedures and instructions of these organizations and ensure that provisions are incorporated for correct performance of design activities, including specifying appropriate quality standards in design documents and identifying, documenting, and controlling deviations from such standards and subsequent corrective actions. While most design verification is completed prior to procurement, certain analyses such as piping stress reports require verification

after installation . This verification will be completed prior to fuel load. Documentation will be such that unverified portions are appropriately identified and controlled. PSI shall verify proper implementation of approved procedures and instructions through audit of principal contractor design activities, and records as well as through review of resulting design output documents.

1.3.2 Application Review

Review and selection for application suitability of materials, parts, equipment, processes, and "off-the-shelf" items that are essential to safety-related equipment shall be conducted by principal contractors. The measures PSI will employ to assure the adequacy of such application reviews are as follows:

a. review principal contractors' practices to assure the correctness and adequacy of methods;

b. audit and surveillance of principal contractors' activities, facilities, and records to verify implementation of procedures and instructions; and

c. monitoring of deviations and nonconformances and directing appropriate disposition and corrective action as necessary.

Since design reviews were performed during the Byron Station design, it will not be required that they be performed again except in the case where the design is not duplicated. Selection of materials, parts, equipment, and processes must include the use of valid industry standards and specifications, material and prototype hardware testing programs, and design reviews.

1.3.3 Design Control

Application of replicate and non-replicate design control measures to such aspects of design as reactor physics; seismic, stress, thermal, hydraulic, radiation, and accident analysis; materials compatibility; and accessibility for maintenance, inservice inspection, and repair shall be formulated and presented as written procedures and instructions by cognizant design contractors. The design contractors shall also delineate acceptance criteria for inspections and tests of structures, systems, and components under their design responsibilities. PSI ensures the adequacy of design control measures and acceptance criteria utilizing the basic methods outlined in Subsection 1.3.2.

Design changes, modifications or new design features of the replicate design shall have design reviews and controls equivalent to the original design. Design and procurement documents are controlled to assure replicate and non-replicate identification. In addition, PSI shall review procurement specifications and safety-related selected design output documents based on complexity, licensing issues, experience with similar designs, and new regulating requirements, and perform comprehensive design reviews of selected system interrelationships to further develop confidence in the effectiveness of design control methods. No change is authorized for construction until the design change is approved to assure that designs are kept current with as-built configurations. PSI Project Management Procedures require that approved drawings and specifications be updated to incorporate approved changes after a fixed number of changes or a designated time period, whichever is sooner.

1.3.4 Design Verification and Checking

Provisions for verifying or checking design adequacy under the most adverse conditions, including the identification of positions or organizations responsible, shall be established by the cognizant design contractors. During review of safety-related suppliers/contractors' written procedures and instructions, PSI will assure that measures such as design reviews, use of alternative calculational methods, or qualification testing are prescribed and that the verifying or checking process is performed by authorized individuals or groups other than those who performed the original design or the designer's immediate supervisor. The Quality Assurance Program requires that computer codes used for design verification and analysis shall be documented and qualified by testing or other calculational means and approved for a particular use prior to use. Audits of contractors' activities, facilities, and records and review of selected safety-related design documents by PSI ensure compliance with written procedures for design verification of non-replicate designs and proper inclusion of replicate requirements in design documents.

1.3.5 Design Interface Control

S&L is responsible for verifying replicate and non-replicate features and identifying the external design interfaces on Marble Hill Project. Each individual design organization is responsible for controlling interfaces between internal groups and positions.

External design interface control measures include review, approval, release, distribution, collection, and storage of design documents and changes thereto. Design documents shall also be controlled to prevent inadvertent use of superseded design information. These control measures are prescribed by S&L procedures and instructions, reviewed and approved by PSI, and verified through audit and review of design output documents.

1.3.6 Design Change Control

Design changes and field changes for the Marble Hill Project shall be reviewed, approved, released, and distributed by the design organization responsible for the original design. The cognizant design organization shall utilize written procedures and instructions acceptable to PSI for controlling design changes and field changes. The PSI Marble Hill Project organization will utilize written procedures for screening, handling, and controlling field change requests. PSI Project Engineering Section will exercise final approval for change requests, design changes, and field changes which affect PSAR commitments or design criteria.

The design change process shall be monitored through audit and surveillance of design organizations and construction management groups by PSI quality assurance personnel. Audits and surveillance also ensure that design documents and reviews, records, and changes thereto are collected, stored, and maintained in a systematic and controlled manner in accordance with written procedures.

1.4 Procurement Document Control (PSI)

1.4.1 Procurement Document Control

Non-replicate procurement documents (contracts and specifications) prepared by S&L for the Marble Hill Project shall be reviewed by PSI Project Engineering and Quality Assurance personnel prior to issuance.

Changes to replicate procurement documents shall be given the same review and control as non-replicate procurement documents, including quality assurance review and approval. Methods and responsibilities for the PSI review are prescribed by a PSI Project Management Procedure governing the procurement document review process. A technical review of safety-related specifications by the PSI Project Engineering Section shall ensure that procurement documents contain or reference the following technical requirements:

a. regulatory requirements;

b. components and equipment identification requirements;

c. drawings;

d. specifications;

e. codes and industrial standards;

f. test and inspection requirements and

g. special process instructions for such activities as welding, heat treating, nondestructive examination, and cleaning.

A review of safety-related specifications by the PSI Quality Assurance Department shall ensure that procurement documents contain the following:

a. identification of the applicable 10 CFR 50, Appendix B, requirements which must be complied with and described in the supplier's QA program;

b. identification of the documentation (e.g., drawings, specifications, procedures, inspection and as-built drawings, inspection and test records, personnel and procedure qualifications, and material, chemical, and physical test results) to be prepared, maintained, and submitted, as applicable, to the purchaser for review and approval;

c. identification of those records which shall be retained, controlled, maintained, or delivered to the purchaser prior to use or installation of the hardware;

d. requirements for the purchaser's right of access to supplier's facilities and applicable records for source inspection, surveillance, or audit; and

e. provision for supplier reporting and disposition of nonconformances from procurement requirements.

Procurement documents developed for PSI by Sargent & Lundy for replicate designs may be accepted after review and issuance of a certificate of conformance to replicate criteria by Sargent & Lundy, and where applicable, for financial and legal reviews afforded all procurement documents. PSI reviews of procurement documents shall be documented as specified in PSI Project Management Procedures and retained as quality verification records.

1.4.2 Procurement Document Control Responsibilities

Westinghouse has been delegated control responsibility for preparation, review, approval, and issuance of procurement documents and changes or revisions thereto associated with the NSSS. Sargent & Lundy has been delegated control responsibility for preparation and review of procurement specifications and changes or revisions thereto associated with the Balance of Plant. PSI will approve and issue Sargent & Lundy prepared procurement documents to bidders. PSI requires S&L and Westinghouse to submit to PSI written quality assurance procedures or instructions governing these activities. PSI reviews and accepts such procedures or instructions in accordance with written PSI review procedures. The PSI review ensures that the following aspects are included:

a. Procurement document control responsibilities are clearly delineated.

b. Action sequences for preparation, review, approval, and issuance of procurement documents are specified.

c. Internal reviews of procurement documents are conducted by qualified personnel.

d. Internal reviews of procurement documents determine that quality requirements are correctly stated, inspectable, and controllable; there are adequate acceptance and rejection criteria; and the document has been prepared in accordance with QA program requirements.

e. Changes or revisions to procurement documents are subject to the same review and approval requirements as the original documents.

The PSI audit program of principal contractors shall be utilized to confirm and verify implementation of procedures or instructions accepted by PSI.

1.4.3 Supplier Requirements

The quality assurance specification prepared and issued by PSI to principal contractors and contractors includes requirements to pass on applicable quality assurance requirements to subtier contractors or suppliers. Therefore, it is incumbent upon contractors to prepare procurement documents for suppliers which require an established and implemented supplier quality assurance program for purchased materials, equipment, and services to an extent consistent with their importance to safety. PSI confirms through audits or review that procurement documents include quality assurance program requirements for suppliers.

PSI evaluates recommendations of suppliers for award of contracts or issuance of purchase orders. Through routine audits, PSI shall confirm that S&L and Westinghouse had adequately evaluated the recommended supplier to assure that the supplier can meet the procurement requirements.

PSI shall evaluate the quality assurance program of its contractors prior to award of contracts or issuance of purchase orders. PSI shall also require that its principal contractors and contractors evaluate the quality assurance programs of their subcontractors to assure these subcontractors meet the PSI quality assurance requirements prior to award of contracts or purchase orders.

The measures employed by PSI for control of procurement documents as described above are independent of whether the purchase of items, materials, or services is for original equipment or spare or replacement items. Therefore, controls for spares or replacements are equivalent to those used for original equipment.

1.5 Instructions, Procedures, and Drawings (PSI)

1.5.1 Documentation and Implementation

Table 1-2 provides a listing of PSI Project Management Procedures which prescribe methods and responsibilities for conduct of activities affecting quality in compliance with the 10 CFR 50, Appendix B, criteria. PSI activities include project management, design control, procurement control, construction management, preoperational and startup testing, and quality assurance. Responsibility for functional activities affecting quality such as design and engineering, procurement, manufacturing, fabrication, construction, erection, installation, testing, and inspection have been delegated to principal contractors and subtier contractors. PSI requires each contracting organization to develop an implement written instructions, procedures, or drawings for performance of all quality-related activities, including quality assurance or quality control audits of internal and external functions. Clear delineation of the sequence of actions to be accomplished in the preparation, review and control of instructions, procedures, and drawings is provided by PSI Project Management Procedures and is required of all PSI contractors.

PSI shall verify the existence and satisfactory implementation of required instructions, procedures, and drawings through its audit and surveillance programs (internal and external).

1.5.2 Acceptance Criteria

For activities where specific qualitative or quantitative standards exist, itemized acceptance criteria shall be included in the instructions, procedures, or drawings governing the activity. Inclusion of appropriate acceptance criteria shall be assured during review and approval of specifications, procedures, or drawings. Reviewers and approval authorities are designated in applicable PSI Project Management Procedures.

1.6 Document Control (PSI)

1.6.1 Control Procedures

PSI has established Project Management Procedures to ensure that PSI-originated documents such as drawings, procedures, and specifications, including changes thereto, are reviewed for adequacy and approved for release by authorized PSI personnel. These procedures also prescribe methods for distribution and receipt acknowledgement of document requiring updating at the location where the prescribed activity is performed. PSI Project Management Procedures identify the individual or groups responsible for reviewing and issuing these documents including the approval by the Quality Assurance Manager.

PSI procedures establish requirements for document control which include the following:

a. Documents, and changes thereto, are reviewed prior to release to assure that the quality requirements are sufficiently, clearly, and accurately state, and authorized.

b. Individuals or groups responsible for reviewing, approvng, and issuing documents and revisions thereto are identified.

c. Changes are reviewed and approved by the same individuals who performed the original review and approval unless other qualified individuals are designated in writing.

d. Approved changes to instructions, procedures, drawings, and other appropriate documents are promptly issued.

e. A document register distributed monthly containing listings of current revisions and changes to all instructions, procedures, specifications, drawings, and procurement documents is established to assure that obsolete or superseded documents are purged from the system and not used. Superseded documents which are retained for reference purposes shall be marked or identified as "Superseded".

f. Documents are distributed promptly to ensure availability prior to commencement of work for which they are needed.

g. Document copies which are microfilmed and retained for reference purposes shall have their use controlled by Project Management Procedures which require controls similar to "e" above, or verification of proper revision against the master status lists and the list of effective pages, if applicable, prior to use in activities affecting quality

1.6.2 Review and Approval

Documents which are safety-related, and changes thereto, shall be reviewed and approved by the same organizations who performed the original review and approval unless other qualified organizations are designated in writing to perform these functions. Types of documents which are controlled include:

a. Design Documents, such as Design Contractor-Prepared Drawings, Field Change Requests and Engineering Change Notices.

b. Procurement Specifications.

c. Manufacturing Documents, such as Technical Manuals.

d. Installacion-Construction Documents, such as Contractor Procedures.

e. Receiving and Storage Documents, such as Storage Procedures.

f. Quality Assurance Manuals and Project Management Procedures.

g. Preoperational and Startup Test Records.

h. Test Procedures, and

i. PSAR and related Design Criteria Documents.

PSI requires that principal contractors and suppliers establish procedures for document control which comply with 10 CFR 50, Appendix B, and PSI requirements. PSI shall review and accept these procedures and subsequently confirm proper implementation and verify their effectiveness through audit or surveillance of facilities, activities, and records.

1.7 Control of Purchased Material, Equipment, and Services (PSI)

1.7.1 Conformance Assurance

PSI assures that material, equipment, and services procured by or for PSI conform to procurement document requirements. Measures employed by PSI include evaluation and selection of suppliers; surveillance of suppliers' facilities; inspection of procured items at the source of supply or upon receipt; and examination, acceptance, and retention at the plant site of documentary evidence of conformance to procurement requirements. PSI delegates responsibility for implementation of some of these measures to principal contractors or consultants but controls these organizations through review, audit, or surveillance.

PSI has conducted evaluations of the S&L and Westinghouse organizations to assess their capability to provide acceptable quality services and products. The evaluations were accomplished utilizing PSI management, engineering, and quality assurance personnel. S&L and Westinghouse were judged acceptable based upon the following:

a. capability to comply with the elements of 10 CFR 50, Appendix B;

b. historical evidence of providing quality items and services; and

c. facilities, personnel, and quality assurance programs capable of meeting design, manufacturing, and quality requirements (based upon surveys by PSI).

Prior to bid award, Quality Assurance participates in evaluation of the bid, assures there are no unresolved exceptions to quality requirements and that the supplier/contractor has been evaluated for adequacy of its Quality Assurance Program and for Quality Assurance capability. The Quality Assurance Department maintains an approved supplier and contractor list.

PSI Quality Assurance has overall responsibility for the establishment and direction of the surveillance program of its contractors. PSI may delegate responsibility for performance of surveillances at its contractors facilities to its architect-engineer or other qualified agents. PSI Quality Assurance may select personnel to participate in the surveillance program from other departments or organizations within PSI based on the experience, background, and qualification of these personnel. Surveillances of PSI contractors, whether conducted by PSI or its agents, shall be performed by qualified personnel and conducted in accordance with written procedures to verify compliance with quality requirements.

S&L, Westinghouse, and contractors are responsible for performing surveillance at the subcontractors facilities in accordance with written quality assurance procedures to verify compliance with quality requirements. PSI shall review and accept written quality assurance procedures as well as source surveillance and test plans of the principal contractors. PSI shall select surveillance and tests for which PSI will accompany principal contractors or contractors during their surveillance of suppliers. PSI also requires the principal contractors and contractors to notify PSI prior to performance of these selected surveillance points. During review and acceptance of surveillance procedures, PSI shall ensure that the procedures provide for:

a. instructions that specify the characteristics or processes to be witnessed, inspected, or verified, and accepted; the method of surveillance and the extent of documentation required; and those responsible for implementing these instructions (including qualification requirements for surveillance personnel); and

b. audits and surveillance which assure that the supplier complies with all quality requirements. Surveillance should be performed on those items where verification of procurement requirements cannot be verified upon receipt.

Where required, S&L, Westinghouse, and/or designated agents shall provide source inspectors to ensure quality compliance at suppliers' facilities. PSI Quality Engineering determines the extent to which purchased items will be verified by PSI at sources. Source Surveillance and Receipt Inspection is conducted by the PSI Inspection Section in accordance with approved plans and checklists. Receipt inspections at the construction site shall be performed by the PSI Inspection Section for material procured by Westinghouse or PSI (owner furnished material) and by the construction contractor for material which is contractor procured. Inspections shall be performed in accordance with written procedures, reviewed and accepted by PSI, which include the following provisions:

a. Materials, equipment, or components are properly identified and correspond with associated documentation.

b. Specific inspection instructions and acceptance criteria are delineated.

c. Inspections are performed and materials, equipment, components, and acceptance records are judged acceptable prior to installation or use.

d. Inspection records or quality release forms (certificates) of conformance attesting to the acceptance of materials, equipment, and components are completed and made available at the power plant site prior to installation or use.

e. Items accepted or released are identified as to their inspection status prior to forwarding them to a controlled storage area or releasing them for installation or further work.

f. Nonconforming items are segregated, controlled, and clearly identified until proper disposition is made.

In addition to inspection records or quality release forms completed by the source or receipt inspector, suppliers of items affecting the quality of the nuclear plant shall be required to furnish the following records:

a. Quality release forms that specifically identify (e.g., by purchase order number, specifictions and revisions, component or equipment identification) the purchased material or equipment and the specific procurement requirements (codes, standards, specifications, and revisions) met by the items; and

b. Quality release forms that identify any procurement requirements which have not been met together with a description of those deviations with approved disposition of "use-as-is" or "repair."

These quality release forms shall be reviewed during receipt inspection by the PSI Quality Assurance Inspection Section. PSI shall insure that the Quality Release Form review is performed by a qualified individual through review of qualification records and surveillance of receipt activities.

1.7.2 Audits and Surveillance

PSI shall verify adherence to procedures and instructions for control of purchased material, equipment and services through audits of principal contractors and selected suppliers and contractors as described in Subsection 1.18 of this document.

PSI Inspection Section performs surveillance of construction contractors and subcontractors. This surveillance effort includes the following:

a. frequent surveillance planning meetings between a PSI Inspection Section representative and the coustruction contractor's QA/QC supervisors to coordinate and establish common direction in surveillance,

b. assignment of personnel and performance of surveillance,

c. formalized written reporting of surveillance activities and results based on data and comments recorded during surveillance,

d. retention of surveillance reports as quality verification records, and

e. controlling deviations identified as the result of surveillance and insuring corrective action is implemented.

1.8 Identification and Control of Materials, Parts, and Components

PSI requires that principal contractors and contractors identify and control materials, parts, and components in accordance with 10 CFR 50, Appendix B, and applicable codes and standards, and that these requirements be passed on to subtier contractors or suppliers as appropriate. PSI will maintain cognizance of and responsibility for the identification process by reviewing and accepting (or designating an agent to do so) contractors' and suppliers' written procedures or instructions governing this activity. The review shall ensure that the following elements are incorporated into procedures and instructions:

a. Procedures and instructions govern identification and control of materials, parts, and components including partially fabricated subassemblies.

b. Identification requirements are determined during initial planning stages.

c. Mechanisms for traceability of identifications of materials and parts to the appropriate documentation (drawings, specifications, purchase orders, manufacturing and test documents, deviation reports, and physical and chemical mill test reports) are delineated.

d. Locations and methods of identification are selected so as not to affect the function or quality of the item.

e. Effective measures for verification of correct identification are prescribed including documentation of verification prior to release for fabrication, assembling, shipping, or installation.

f. Consumable materials which impact safety, such as weld filler, metals, grout, preservatives, coating materials, and certain lubricants are identified, stored and controlled to protect quality.

PSI will verify adherence to procedures and instructions for identification and control of materials, parts and components through audits of principal contractors, contractors, subcontractors and suppliers of safety-related items as described in Subsection 1.18 of this document.

PSI shall verify adherence to procedures and instructions by construction contractors for identification and control of materials, parts and components through surveillance as described in Subsection 1.7 of this document.

1.9 Control of Special Processes (PSI)

There are certain processes the quality of which cannot be verified by direct inspection of the product. Such processes have been classified "special processes". PSI requires that the principal contractors and contractors provide controls to assure qualification of procedures and personnel required to perform special processes, including welding, heat treating, painting, electrochemical machining, coating, cleaning and flushing, and nondestructive examination, and that these requirements be passed on to applicable subtier contractors or suppliers. Quality Engineering, based on review of drawings and specifications, is responsible for identifying those processes requiring special controls and the methods for qualifying or certifying equipment, procedures or personnel necessary to their performance.

PSI requires that contractors and suppliers establish measures for the control of special processes, which include the following:

a. Adequate performance and control of special processes such as welding, heat treating, and nondestructive testing.

b. Procedures, equipment, and personnel connected with special processes are qualified in accordance with codes, standards, and specifications, or, when necessary, supplementary procedures.

c. Accomplishment of special processes performed by qualified personnel are documented by written process sheets, shop procedures, checklists, travelers, or equivalent, to provide for recording evidence of verification and, if applicable, inspection and process results.

d. An active file is maintained and kept current on qualification records of all special process procedures, equipment, and personnel performing special processes.

PSI will verify adherence to procedures and instructions for control of special processes through audits of principal contractors, contractors and suppliers of safety-related items as described in Subsection 1.18 of this document.

PSI will verify adherence to procedures and instructions by construction contractors for control of special processes through surveillance as described in Subsection 1.7 of this document.

1.10 Inspection (PSI)

1.10.1 Inspection Program

Inspection programs shall be established and implemented by or for contractors or suppliers performing activities affecting the quality of safety-related products or materials. Inspection methods and responsibilities shall be prescribed by written procedures and instructions within each organization performing these activities. All such procedures and instructions will be reviewed and approved by PSI or a designated principal contractor. The reviews ensure that the following provisions are included:

a. Inspection personnel are identified and appropriately qualified in accordance with applicable codes, standards, and company training programs and are independent of the individual or groups performing the activity being inspected. Except for nondestructive examiners, who are required to be qualified to SNT-TC-1A, inspection and test personnel are required to be trained, qualified and certified to ANSI N45.2.6-1973.

b. Indirect control by monitoring processing methods, equipment, and personnel is used if direct inspection of processed material or products is impossible or disadvantageous.

c. Both inspection and process monitoring are used when control is inadequate without both.

d. Inspection procedures and instructions are made available with necessary drawings and specifications for use prior to performing inspections. Procedures, instructions, and checklists contain the following:

   1. identification of characteristics to be inspected,

   2. identification of the individuals or groups responsible for performing the inspection operation,

   3. acceptance and rejection criteria,

   4. a description of the method of inspection,

   5. verification of completion and certification of inspection,

   6. a record of the results of the inspection operations,

   7. specification of inspection methods to achieve the required accuracy.

e. Inspectors' qualifications and certifications are kept current.

f. Replaced or reworked items are inspected in accordance with appropriate inspection requirements.

g. Modified or repaired items are inspected by methods which are equivalent to the original inspection method.

Receipt inspection of owner furnished materials will be conducted by the PSI Inspection Section.

PSI shall verify adherence to procedures and instructions for inspection through audits of principal contractors, contractors and selected subcontractors and suppliers as described in Subsection 1.18 of the document.

PSI shall verify adherence to procedures and instructions by construction contractors for inspection through surveillance as described in Subsection 1.7 of this document.

The PSI Quality Assurance Inspection Section will monitor quality-related activities of the PSI Marble Hill Project organization and contractors at the Marble Hill site. Schedules of construction, erection, and installation activities shall be provided to PSI in advance of performance of these activities. PSI specifies mandatory inspection hold points at significant points in the process.

Inspection staffing is planned in relation to short and long range schedules that identify manpower needs. In addition, the Superintendent Inspection participates in regular project meetings that address specific schedule and work assignments. Work will not be allowed to proceed that is not adequately staffed by qualified inspectors from the Contractors and PSI.

Contractors shall be required to obtain documentation by PSI or its designated representatives of the witnessing or inspection of hold points or obtain a waiver of the inspection by PSI in order to continue work progress beyond the designated hold point. Any waivers shall be documented by follow-up correspondence.

In a similar manner, Westinghouse is the designated PSI representative for surveillance of NSSS manufacturing and fabrication subcontractors and is responsible for developing systems whereby mandatory inspection hold points are specified. These systems will be reviewed and approved by PSI as well as the resulting hold point/inspection schedule. PSI maintains the option to accompany Westinghouse personnel during witnessing or inspection at predetermined hold or notification points.

1.11 Test Control (PSI)

1.11.1 Test Program

The PSI testing program described in Chapter 14.0 of the PSAR governs preoperational and startup testing activities. Preoperational testing consists of those tests conducted subsequent to construction inspections and tests but prior to fuel loading. Startup testing includes fuel loading tests, precritical tests, low-power tests (including criticality), and power ascension tests. The testing program will be administered and controlled by a preoperational test organization reporting to the Licensing Manager and reviewed by a Joint Test Group comprised of PSI Operations, Construction, and Project Engineering as well as a representative of Westinghouse.

The formation of the Joint Test Group facilitates control of management and technical interfaces between PSI Operations, Construction Management, Engineering Contractors as well as Sargent & Lundy and Westinghouse. The Station Manager or his designee will be chairman of the Joint Test Group.

Written test procedures will be prepared by a preoperational test organization (as described in Chapter 14.0 of the FSAR) and will include purpose, scope, prerequisites, system initial conditions, special precautions, procedures, acceptance criteria, and reference documents. Plant operational and technical personnel shall be appropriately qualified and trained as described in Sections 13.1 and 13.2 of Chapter 13.0 of the PSAR.

PSI preoperational and startup testing activities are governed by documented procedures reviewed and concurred in by the Quality Assurance Department.

1.11.2 Test Procedures

PSI test procedures include the following provisions:

a. Prerequisites — those items of work which must be completed prior to establishing initial conditions for the test, including:

   1. calibrated instrumentation;

   2. adequate and appropriate equipment;

   3. preparation, condition, and completeness of the item to be tested;

   4. suitable environmental conditions, if applicable; and

   5. data sheets

b. Trained Personnel — trained, qualified or certified personnel conduct testing.

c. System Initial Conditions — component/equipment status prior to active testing. Special environmental conditions are stated if applicable.

d. Special Precautions - items needed for safety of personnel or equipment. Special situations where caution or extraordinary attentiveness to operational circumstances is required.

e. Procedure Sequence — steps required by design or procurement documents to conduct the test, observations to be made, instrumentation and test equipment needed, data to be recorded, nonstandard system conditions, and use of administrative control documents

f. Inspection Hold Points -- mandatory inspection hold points for witness by Quality Assurance Operations Group.

g. Acceptance Criteria — design or procurement document criteria against which success or failure of the test can be determined.

h. References — documents and sources of information used in test preparation indicating effective revision utilized as applicable.

PSI requires principal contractor, contractors and suppliers performing fabrication and construction testing to develop procedures to conform with these requirements as applicable.

PSI will verify adherence to procedures and instructions for test control through audits of principal contractors and selected contractors and suppliers as described in Subsection 1.18 of this document.

PSI will verify adherence to procedures and instructions by construction contractors for test control through surveillance as described in Subsection 1.7 of this document.

1.11.3 Test Results

Written PSI test procedures incorporate test performance and data sheets for recording equipment serial numbers and test results. Data sheets will be distributed to designated data recorders, operators, or supervisors prior to commencement of testing, and personnel will be briefed to ensure all necessary information is properly recorded. When tests have been completed, data sheets will be collected and assembled to form a test records package. Packages will be analyzed and evaluated against pre-established acceptance criteria. Additionally, the Joint Test Group will review and concur with test results. As required by individual tests, principal contractors will review results. Final acceptance or rejection of system performance is the responsibility of the Station Manager. The complete test package, including the test procedure, completed data sheets, evaluation reports, and final disposition, shall be retained as a quality verification record per PSI Project Management Procedures.

1.12 Control of Measuring and Test Equipment

The PSI quality assurance specification requires that contracting organizations performing quality-related activities requiring use of measuring and test equipment establish measures to assure that tools, gauges, instruments, and other measuring and testing devices are of the proper type, range and accuracy for their application. To assure accuracy, the measuring devices are properly controlled, calibrated, and adjusted at specified periods or prior to use. PSI or its designated agent shall review the resulting procedures or instructions prepared by applicable contractors to verify inclusion of the following provisions:

a. description of the calibration technique, calibration frequency, and maintenance and control of all measuring and test instruments, tools, gauges, fixtures, reference standards, transfer standards and nondestructive test equipment which is to be used in the measurement, inspection, and monitoring of safety-related components, systems, and structures;

b. provisions for unique identification of measuring and test equipment and for correlation between calibration test data and the equipment to which it applies;

c. provisions for determination of calibration frequency requirements for equipment based on the required accurancy, purpose, degree of usage, stability characteristics, and other conditions affecting the measurements;

d. requirements for use of calibrating standards which have known relationships to nationally recognized standards, or if no national standards exist, the basis for calibration is accurately documented. The error of the calibration standard must be less than the error of production measuring and test equipment;

e. provisions for recording and maintaining records indicating the complete status of all items under the calibration system and

f. provisions for conducting investigations to determine the validity of previous inspections performed when measuring and test equipment is found to be out of calibration.

The Superintendent-Inspection has the responsibility for maintaining the calibration program. PSI shall require that measuring and test equipment have an uncertainty (error) of no more than 1/4 of the tolerance of the parameter being measured as established by the functional design requirements, unless limited by the practical limits of the state of the art. When the uncertainty of the measuring and test equipment is exactly equal to 1/4 of the tolerance of the parameter being measured, calibration standards used to calibrate the measuring and test equipment shall have an uncertainty of no more than 1/4 of the tolerance of the equipment being calibrated, unless limited by the practical limits of the state of the art. When the uncertainty of the measuring and test equipment is less than 1/4 of the tolerance of the parameter being measured, the following requirements shall apply unless limited by the practical limits of the state of the art:

a. The combined uncertainty (error) of the measuring and test equipment (M&TE) and calibration standard shall be equal to or less than the total uncertainty which would result from use of M&TE with uncertainty equal to 1/4 of the tolerance of the parameter being measured, and which is calibrated by a standard with an uncertainty equal to 1/4 of that M&TE uncertainty.

b. The uncertainty of the calibration standards shall be equal to or less thant the tolerance of the equipment being calibrated.

PSI shall verify adherence to procedures and instructions for control of measuring and test equipment through audits of principal contractors and selected contractors and suppliers as described in Subsection 1.18 of this document.

PSI shall verify adherence to procedure and instructions by construction contractors for control of measuring and test equipment through surveillance as described in Subsection 1.7 of this document.

1.13 Handling, Storage, and Shipping

PSI Project Quality Assurance Manual includes procedures governing the handling and storage of owner furnished materials at the construction site. Instructions will be developed by the PSI Marble Hill Project organization to supplement special procedures and requirements issued by the suppliers and principal contractors.

These instructions will be reviewed by PSI Quality Assurance to assure that the following provisions are included:

a. Procedures and instructions accurately reflect and comply with design and specification requirements.

b. Special handling, preservation, storage, cleaning, packaging, and shipping requirements are delineated.

c. Activities are accomplished by appropriately trained and experienced individuals.

d. Special protective environments such as inert gas atmosphere, specific moisture content levels, and temperature levels are specified when necessary for particular products.

PSI has delegated responsibility for specifying handling, storage, shipping, cleaning, and preservation of material and equipment requirements to its principal contractors and contractors. The PSI quality assurance specification governing principal contractors and contractors provides for passing applicable requirements on to their subcontractors and suppliers as appropriate. In any case, the organization performing handling, storage, or shipping activities shall develop predetermined work and inspection instructions and procedures for accomplishing these activities. Instructions and procedures so developed by contractors shall be reviewed and accepted by PSI or its designated agent (i.e., principal contractors).

PSI shall verify adherence to procedures and instructions for handling, storage and shipping through audits of principal contractors, contractors and selected subcontractors and suppliers as decribed in Subsection 1.18 of this document.

PSI shall verify adherence to procedures and instructions by construction contractors for handling, storage and shipping through surveillance as described in Subsection 1.7 of this document.

1.14 Inspection, Test, and Operating Status

The PSI Quality Assurance Program requires that principal contractors and contractors establish measures to indicate, by use of stamps, tags, labels, routing cards, or other suitable means, the status of inspections and tests performed on structures, systems, or components. These measures provide for the identification of items which have satisfactorily passed required inspecions and tests, and provisions to preclude inadvertent bypassing of such inspections and tests.

PSI requires that principal contractors and contractors establish measures which include the following:

a. that measures be established and documented to identify the inspection, test, and operating status of structures, systems, and components throughout manufacturing and installation;

b. that measures be established to control the use of inspection and welding stamps and status indicators including the authority for application and removal of tags, marking, labels, and stamps;

c. that the bypassing of required inspections, tests, and other critical operations be controlled through documented measures under the cognizance of the QA organization; and

d. that the status of nonconforming, inoperative, or malfunctioning structures, systems, or components is clearly identified to prevent inadvertent use.

The written quality assurance procedures or instructions developed by principal contractors or contractors to fulfill the control requirements will be reviewed and accepted by PSI. The written quality assurance procedures or instructions developed by contractors shall be reviewed and accepted by PSI or PSI's designated representative (i.e., principal contractors).

PSI shall verify adherence to procedures and instructions for control of inspection, test and operating status through audits of principal contractors, contractors and selected subcontractors and suppliers as described in Subsection 1.18 of this document.

PSI shall verify adherence to procedures and instructions by construction contractors for control of inspection, test and operating status through surveillance as described in Subsection 1.7 of this document.

PSI is responsible for identifying and controlling the test and operating status of systems and components under preoperational and startup testing. PSI will establish procedures for tagging systems under test to indicate custody and operating status. Tags shall be utilized to prevent incorrect or inadvertent operation of equipment under test and to prevent damage to equipment or danger to personnel. Application and removal of tags shall be strictly controlled through utilization of tag control logs, designation of individuals authorized to apply or remove tags, and use of signatures to indicate responsibility for actions. Surveillance of testing activities by PSI Quality Assurance Operations Group to control bypassing of tests or critical operations will be performed in accordance with PSI Project Management Procedures.

1.15 Nonconforming Materials, Parts, or Components

During the design/procurement/construction phase of the Marble Hill Project, nonconformances in materials, parts, or components may be discovered through review, inspection or testing during manufacture or fabrication, or through functional testing. The PSI Quality Assurance Program provides for control of

nonconforming items discovered by PSI. The following provisions are necessary for acceptance of principal contractor and contractor quality assurance programs by PSI:

a. Control of the identification, documentation, segregation, review, disposition, and notification of affected organization of nonconformance of materials, parts, components, or services.

b. Documentation identifies the nonconforming items; describes the nonconformance, the disposition of the nonconformance, and the inspection used to uncover the nonconformance; and include signature approval of the disposition.

c. Identification of the responsible individual for determining and approving the disposition of nonconforming items.

d. Acceptability of rework/repair of items is verified by reinspecting the item as originally inspected or by a method which is at least equal to the original inspection method and that rework and repair inspection procedures are documented.

e. Interface nonconformances concerning departures from design specifications, and drawing requirements which are dispositioned "use-as-is" and "repair," are formally reported to PSI.

f. The nonconformance reports dispositioned "use-as-is" or "repair" are made part of the inspection records and forwarded with the hardware to the construction site.

g. Periodic analysis of these reports is performed and forwarded to management to show quality trends.

h. Provisions for passing the nonconformance control requirements on to subtier contractors.

Methods prescribed by PSI to implement these provisions include tagging or marking of nonconforming items; physical separation of items to prevent inadvertent use; nonconformance reporting, review, and disposition procedures; maintenance of status logs to ensure complete followup on each nonconformance; review and approval of dispositions and corrective actions effected by contractors; and detailed cause-and-effect analysis where necessary to preclude recurrence. During review of dispositions and corrective actions, PSI shall assure that:

a. Applicable requirements and interfacing items are reviewed.

b. Determination is made whether the problem is an isolated case or a symptom of more far-reaching problems.

c. Applicable portions of the QA Program are reviewed to determine if upgrading is required to preclude recurrence.

d. Cause of problems are determined and appropriate preventive measures are proposed.

In addition to imposing requirements on contractors, PSI ensures procedural compliance by reviewing and approving principal contractors' nonconformance control procedures or instructions.

PSI shall verify adherence to procedures and instructions for control of nonconforming material, parts or components through audits of principal contractors, contractors and selected subcontractors and suppliers as described in Subsection 1.18 of this document.

PSI shall verify adherence to procedures and instructions by construction contractors for control of nonconforming material, parts or components through surveillance as described in Subsection 1.7 of this document.

1.15.1 Identification of Construction Deficiencies by PSI

a. Construction deficiencies representing departures from design requirements that are detected by PSI Quality Assurance personnel performing inspections on items in PSI custody (i.e., first line inspections) shall be documented on a Nonconformance Report.

b. Construction deficiencies representing departures from design requirements that are detected by PSI personnel performing surveillance inspections (i.e., not first line inspection) shall be documented on a Corrective Action Request.

c. Deficiencies that are of a programmatic nature which have been detected either by inspections, surveillances, or audits shall be documented on a Corrective Action Request.

d. Where conflicts occur between drawings, specifications, standards and procedures, the conflict and recommended action shall be documented by PSI or contractor's personnel on a Field Change Request.

e. The responsibilities and methods to be used by PSI personnel to identify and document deficiencies and conflicts on technical requirements are defined in the PSI Marble Hill Project Quality Assurance Manual.

f. The contractors' quality assurance programs are being revised to standardize forms and methods for identifying deficiencies and conflicts as much as practicable.

1.15.2. Evaluations of Construction Deficiencies and Conflicts

a. Nonconformance Reports and Corrective Action Requests shall be initially evaluated by the cognizant PSI Superintendent Quality Engineering to verify information recorded and to determine if the deficiency is a "Potential NRC Reportable Item". If it is a

"Potential NRC Reportable Item", it is submitted to the Marble Hill Safety Review Committee for evaluation and subsequent reporting, if applicable.

b. Evaluation and disposition of PSI Nonconformance Reports shall be done by the PSI Project Engineering Manager and approved by the Manager Quality Engineering and the architect-engineer if the disposition is "Repair" or "Use-As-Is".

c. The PSI Quality Assurance Manager is responsible for evaluation and followup for Corrective Action Requests that are written as a result of repetitive deficiencies, lack of response to previous Corrective Action Requests, or for problems that cannot be resolved at the PSI Manager Quality Engineering level.

The PSI Manager Quality Engineering is responsible for evaluation and resolution on all other Corrective Action Requests.

d. Field Change Requests are evaluated and approved by the same design organization that approved the original document(s) which the Field Change Request affects.

   In addition, Engineering Change Notices may be used by the design organization to make changes to drawings and specifications.

e. The responsibilities and methods for evaluation of construction deficiencies and conflicts is delegated and defined in the PSI Project Quality Assurance Manual.

f. The upgraded staff, the relocation of the project staff to the site to improve communication among the project groups, and the intensified training program being implemented, along with the programmatic controls described above, will provide more timely identification of problems in the future.

1.15.3. Processing of Nonconformance Reports, Corrective Action Requests, and Field Change Requests

a. Project Management Procedures provide time limits and flow paths for the evaluation and disposition of Nonconformance Reports and Corrective Action Requests.

b. Provisions have been made in the administrative procedures to provide timely evaluation and resolution of Nonconformance Reports, Corrective Action Requests, and Field Change Requests. These provisions are briefly described as follows:

   (1) The number of forms to be used for reporting nonconforming conditions and for obtaining approval for design changes has been reduced, and the use of these systems simplified. To the maximum extent possible, these standardized forms and procedures have been established to be used by PSI and the site contractors

to avoid confusion and dual reporting that had occurred previously.

(2) As part of the computerized tracking and trending program, ten (10) day and thirty (30) day overdue reports will be used, sorted by responsible organization, on outstanding Nonconformance Reports and Corrective Action Requests. These reports will provide visibility to the appropriate levels of management to take necessary action to maintain timely evaluation and disposition.

1.16 Corrective Action

1.16.1 Identification of Adverse Conditions

Conditions adverse to quality may be identified through PSI review of documents, conduct of surveillance, performance of audits, and conduct of preoperational and startup testing. Failures, malfunctions, deficiencies, deviations, defective materials and equipment, and nonconformances identified by PSI shall be documented on PSI deviation control records by the cognizant PSI reviewer, auditor, or inspector. PSI informs the principle contractors and contractors of conditions adverse to quality and requires these conditions be controlled in accordance with Subsection 1.15.

1.16.2 Corrective Action

PSI requires the responsible individual, group, or organization to reply to PSI-identified nonconformance by submitting proposed dispositions and corrective actions to PSI for approval. PSI shall review and evaluate the reply in accordance with written procedures to confirm that the cause(s) of the condition has been determined and that appropriate corrective action is planned. PSI may elect to require more comprehensive corrective action if deemed appropriate. Subsequent to approval of PSI proposed dispositions and corrective actions, PSI shall be notified of completion of the disposition action and corrective action carried out by the responsible organization, and the date corrective action was placed in effect. PSI Quality Assurance shall maintain logs indicating the current status of each documented nonconformance identified by PSI to ensure initiation of prompt corrective action to preclude recurrence. PSI Quality Assurance shall include reviews of corrective actions during audit or surveillance of the responsible organization's facilities. Summary reports of the status of deviation dispositions and corrective actions are contained in the monthly activity report to the Vice President-Electric System and Quality Assurance Review Committee.

1.16.2.1 System for Assuring Management Awareness of Problem

a. A program has been established for recording and tracking trends on quality problems identified on Nonconformance Reports and Corrective Action Requests. The PSI Quality Assurance Manager shall conduct a trend analysis review of nonconformances and deficiencies of PSI and its contractors. The Quality Assurance Manager is responsible to take actions to resolve unsatisfactory quality trends.

In addition, the Quality Assurance Manager is responsible to report the results of his review to the Vice President-Electric System in writing. This report is also reviewed by the corporate Quality Assurance Review Committee.

b. Involvement of senior PSI management in site problems and input into correction of those problems occurs in two ways.

Monthly site progress meetings have been instituted and are now being held. Attendance includes key site personnel, such as the Project Director and the Construction, Quality Assurance, Project Control, and Project Engineering Managers or their delegates, and the Chief Executive Officer and Vice President-Electric System of PSI. These meetings are intended to provide both a project status to corporate management and to obtain management direction and solution of site problems.

Site problems or action items are identified to management on a status list and reviewed at the meeting. This list typically includes such items as staffing progress, development of programmatic controls, or site problems requiring management review or input. This list is revised using management input subsequent to each meeting; items which are not dispositioned are carried forward to future meetings.

The responsibility for the Quality Assurance Program rests with the Vice President-Electric System, who is accountable to the President. There is a need, however, to disseminate important information relative to the necessity for and effectiveness of the Quality Assurance Program to other areas of corporate management. Therefore, the Quality Assurance Review Committee has been restructured and is chaired by the Vice President-Electric System. The Committee will not set policy or initiate action since these responsibilities are clearly delegated to the respective line organizations as defined in the Project Quality Assurance Manual. This Committee will meet no less frequently than every two months and more often as project activities require.

1.16.2.2 <u>Description of System to Halt Construction</u>

1.16.2.2.1 <u>System for PSI to Halt Construction</u>

a. PSI Quality Assurance surveillance, inspection, and audit personnel are authorized and assigned the responsibility to stop further processing of unacceptable items or materials by its suppliers and contractors.

The PSI Quality Assurance surveillance, inspection, and audit personnel are responsible for notifying cognizant PSI personnel, the organization being stopped, and are responsible for documenting the unacceptable condition.

b. The PSI Quality Assurance Manager is fully authorized to stop work of any PSI, contractor, or supplier organization which, in his judgment, must be stopped to correct poor quality trends or performance.

This Stop Work authority is of a broader scope than stopping a single process and may include such things as all design activities of an organization, all installation activities of a contractor, or all fabrication or processing of PSI purchased materials or items.

Upon receipt of the Stop Work order, the PSI Project Director is required to take those actions necessary to assure that the work is stopped promptly.

If the activity is ASME Code related, the PSI Quality Assurance Manager shall notify the Authorized Nuclear Inspector.

1.16.2.2.2 Contractor's Systems to Halt Construction

a. To provide assurance that unacceptable work is stopped, qualified PSI Quality Assurance personnel are reviewing the quality assurance programs of site contractors to determine if adequate authority, responsibility and systems are delegated and defined to the contractor's quality assurance personnel, and are acceptable. The criteria used in this review shall be in consonance with the authorities, responsibilities and methods to be used by PSI, i.e. that the contractor's quality assurance personnel have full authority and responsibility to stop unacceptable work, either of a regular item or process nature, or in a broader sense such as stopping all quality related activities of a contractor as a result of unacceptable conditions or quality trends; and that the methods for notification and documenting the stop work are clearly defined.

b. Where the contractors' quality assurance programs are found to be inadequate as a result of this PSI review, the programs are to be revised to an acceptable condition prior to start or restart of activities by that contractor.

1.16.2.3 System for Defining Unacceptable Work

a. The criteria for defining acceptable work is established by engineering drawings, design specifications, and applicable codes and standards. Process controls established in approved work procedures necessary to meet the requirements of the engineering drawings and specifications are also criteria for defining acceptable and unacceptable work.

Criteria for defining acceptable programmatic administrative controls are defined by codes, Federal regulations, ANSI standard, and regulatory guides.

b. Inspection procedures and instructions are to be used by PSI Quality Assurance personnel when conducting surveillance and inspections. As a minimum, these procedures and instructions shall contain: (a) identification of characteristics to be inspected, (b) accept/reject criteria, (c) individuals or groups responsible for the inspection, (d) method of inspection, (e) verification and certification of inspection and, (f) provision for recording the results of the inspections.

   Quality Assurance personnel are required to determine acceptable/unacceptable work based upon the accept/reject criteria established by the Engineering drawings, design specification applicable codes and standards, and are not authorized to permit deviations from these criteria. Where conflicts occur between these criteria documents or in interpretation of the criteria, these conflicts are to be documented on a Field Change Request and resolved by the cognizant design organization.

c. Work control procedures and inspection procedures and instructions are to be prepared by and used by PSI contractors in performance of their construction and inspection activities. These work control procedures and inspection procedures are to be reviewed and approved by PSI Quality Assurance for assurance that qualitative and quantitative accept/reject criteria are adequately defined.

d. PSI and contractors' procedures and instructions which had been approved by PSI Quality Assurance prior to the Confirming Order will be reviewed again and revised as necessary to assure that these documents contain the necessary accept/reject criteria and meet the requirements of the PSI Project Quality Assurance Manual prior to resumption of each type of activity by PSI and the contractors.

e. Pre-planning meetings will be scheduled prior to start of critical or new types of construction activity to review t..e construction procedures and accept/reject criteria. PSI Construction Management and contractor management are attendees at these meetings. These meetings will resolve procedural conflicts and differences in interpretation of accept/reject criteria prior to commencement of the work.

1.16.2.4 Training

To provide assurance that the responsibility to exercise stop work authority when unacceptable conditions are observed and to assure the proper understanding and interpretation of the accept/reject criteria, training programs will be initiated to train construction and inspection personnel. The training program for the Marble Hill Project is described in Section 1.2.5 of this report.

1.17 Quality Assurance Records (PSI)

1.17.1 Records Maintenance

The Manager Quality Engineering is responsible for the designation of quality assurance records to be retained. Project quality assurance records retention is an assigned responsibility of the Superintendent Quality Systems. The records system is primarily based on the retention and availability of microfiche copies at the site and at PSI General Headquarters. In addition, except for radiographs, hard copies of most records are maintained at the site. Radiographs will be stored in a fireproof facility at the General Headquarters location until facilities with similar capabilities are available at the site.

PSI has established Project Management Procedures for control of quality verification records and storage of these records at PSI General Headquarters and at the Marble Hill Station site. These procedures were developed utilizing ANSI N45.2.9 for guidance and the PSI procedures comply with its requirements. The PSI quality assurance procedures specify documents to be retained as quality verification records. The following is a list of the types of documents to be retained:

a. operating logs;

b. results of reviews, inspections, tests, audits, and material analyses;

c. monitoring of work performance;

d. qualification of personnel, procedures, and equipment;

e. drawings;

f. specifications;

g. procurement documents;

h. calibration procedures and reports; and

i. Nonconformance reports dispositioned "use-as-is" or "repair".

Requirements for submission of required records from principal contractors, contractors, and suppliers shall be included in quality assurance specifications which are part of the contract or procurement documents. Requirements for record submission, retention, and maintenance subsequent to completion of work shall be consistent with applicable codes and standards. Where the code requires record retention by the supplier for stated periods, the PSI Quality Assurance Manager shall assure that required verification records are obtained, maintained and retained in accordance with requirements of ANSI N45.2.9.

The content and completeness of quality records will be the responsibility of the originating individual, group, or organization. Content requirements for PSI-originated records are specified by the applicable PSI Project Management Procedure. PSI shall ensure compliance with content requirements from principal

contractors, contractors, subcontractors, and suppliers through review and acceptance of procedures and instructions covering the generation of documents which will be retained as quality verification records. Basic content requirements of inspection and test records applicable to all organizations are as follows:

a. a description of the type of observation;

b. evidence of completing and verifying a manufacturing, inspection, or test operation;

c. the date and results of the inspection or test;

d. information related to nonconformances;

e. inspector or data recorder identification;

f. a statement as to the acceptability of the results· and

g. records shall provide sufficient information to permit identification of the record with the item(s) or activity to which it applies.

1.17.2 Retrievability

PSI will establish a system for filing quality verification records so as to preserve their identity and ensure retrievability at a future date. Computer coding may be used to assign unique numbers to each record and allow for rapid reference to records in storage. The filing system will be used for all quality verification records retained by PSI at the Company General Headquarters and at the Marble Hill Station site.

1.17.3 Storage Facilities

Methods for receipt, screening, classification, and storage of PSI quality records are prescribed by written procedures. In addition, guidelines for establishing permanent storage facilities and the associated security system are also provided in these procedures. ANSI N45.2.9 formed the framework of these procedures and facilities will be established in compliance with its requirements. Records will be maintained at the Marble Hill Site. Except for radiographs, microfiche copies are also maintained at PSI's headquarters. Stringent measures will be taken to assure adequate protection of records.

1.18 Audits

1.18.1 PSI Audit Program

PSI utilizes a comprehensive system of planned and periodic audits to verify all aspects of the PSI Quality Assurance Program and assess its effectiveness. Audits of facilities, records, and activities affecting the quality of safety-related items are conducted by PSI Quality Assurance personnnel, consultants retained to assist in auditing, or other recognized and designated PSI representatives as appropriate. Organizations performing activities affecting quality subject to audit directly by PSI include the following:

a. PSI project, construction, operations, or support organizations;

b. S&L organizations, groups, or individuals:

c. Westinghouse organizations, groups, or individuals (including all support divisions);

d. PSI contractors;

e. selected subtier contractors;

f. construction contractors; and

g. PSI consultants

The Project Quality Assurance Manual includes procedures governing the following aspects of the audit system:

a. scheduling and planning of audits;

b. performance of audits;

c. audit follow-up; and

d. training, qualification, and certification.

PSI audit planning entails identifications of all activities affecting the quality of safety-related structures, systems, and components during design, procurement, manufacturing, construction and installation, inspection, and testing. The following activities are included as a minimum:

a. the determination of site features which affect plant safety (e.g., core sampling, site preparation, and metrology);

b. the preparation, review, approval, and control of the PSAR, design criteria, specifications, procurement documents, instructions, procedures and drawings;

c. request for proposals and evaluation of bids;

d. indoctrination and training programs; and

e. other applicable 10 CFR 50, Appendix B, criteria.

Planning also identifies the organizations, disciplines, and work groups performing each activity. Audit scheduling utilizes work schedules provided by the various organizations to determine the necessary points in the work process for auditing to be accomplished. Criteria for determining dates and frequency of audits are as follows:

a. Quality related activities shall be audited at least once within the lifetime of the activity.

b. Audits shall be initiated early enough to assure effective quality assurance during the activity.

c. Audits shall be conducted at least annually for activities with lifetimes longer than 1 year.

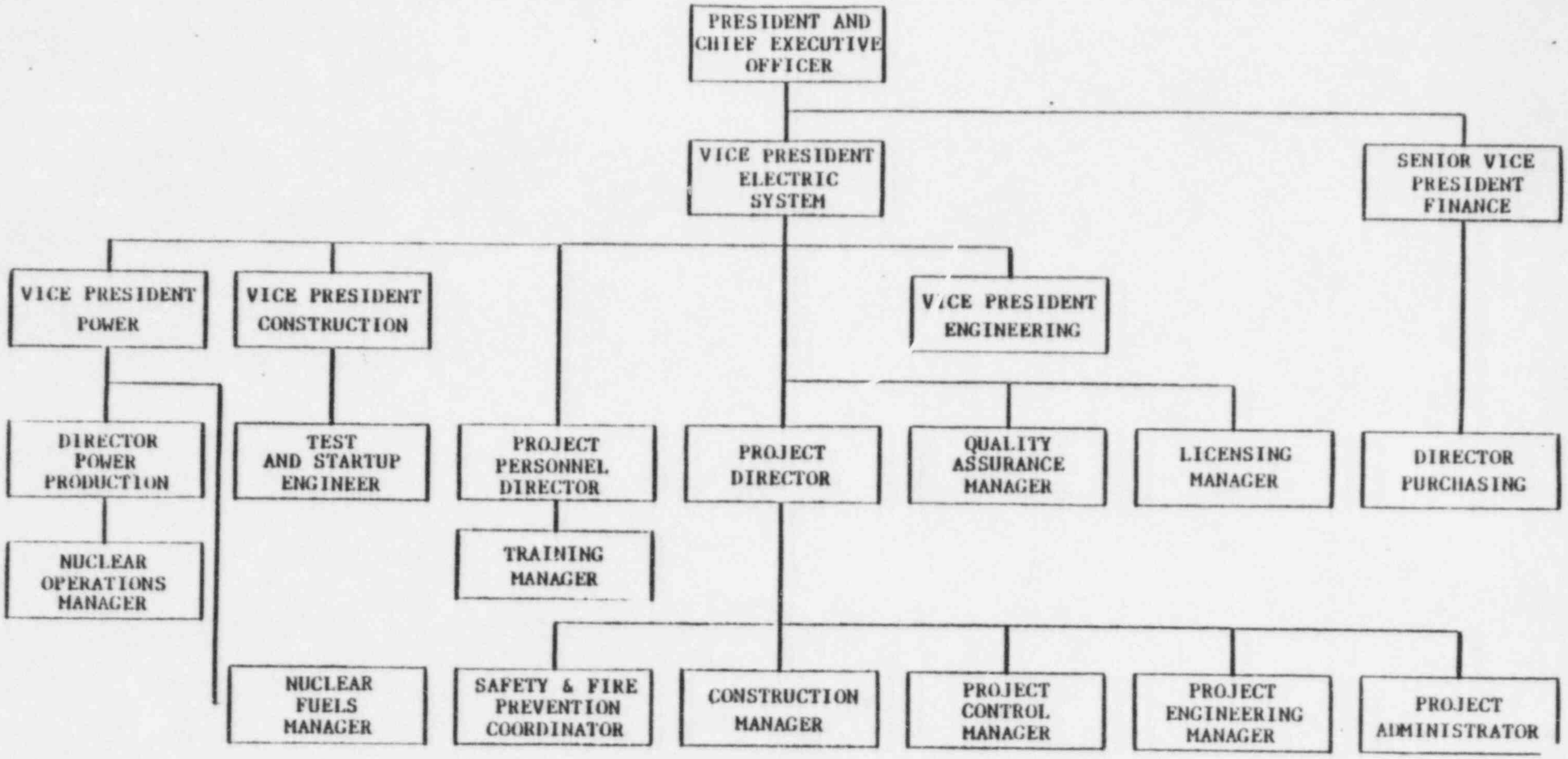
d. Re-audits shall be promptly scheduled to verify corrective actions.

The PSI procedure for conduct of audits prescribes methods and responsibilities for selection of an audit team which is free of direct responsibility for activities to be audited; notification of the organization to be audited; orientation of the audit team; preparation, review, and approval of individual audit plans and detailed checklists; conduct of the audit, including evaluation of work areas, activities, processes, and items, and the review of documents and records, processes, and items, and the review of documents and records, review of audit results with cognizant management; and preparation and submission of the audit report. Individual audit checklists are prepared to ensure that an objective evaluation is conducted of quality-related practices, procedures, and instructions; of the effectiveness of implementation; and of the conformance with policy directives.

Audit follow-up measures include communication with responsible management of the audited organization to resolve difficulties and assure timely response to the audit report, review and approval of proposed corrective actions for cited nonconformances, communication with the audited organization to resolve difficulties regarding implementation of corrective measures and to keep abreast of progress in corrective action, and scheduling re-audits as appropriate to verify the effectiveness of corrective actions. An Audit Control Log is utilized to assist in maintaining current status of follow-up activities.

The PSI training and qualification procedures delineates requirements to assure adequate training and qualification of audit team members. Audit team leaders are trained in accordance with ANSI N45.2.12 and qualified in accordance with ANSI N45.2.23.

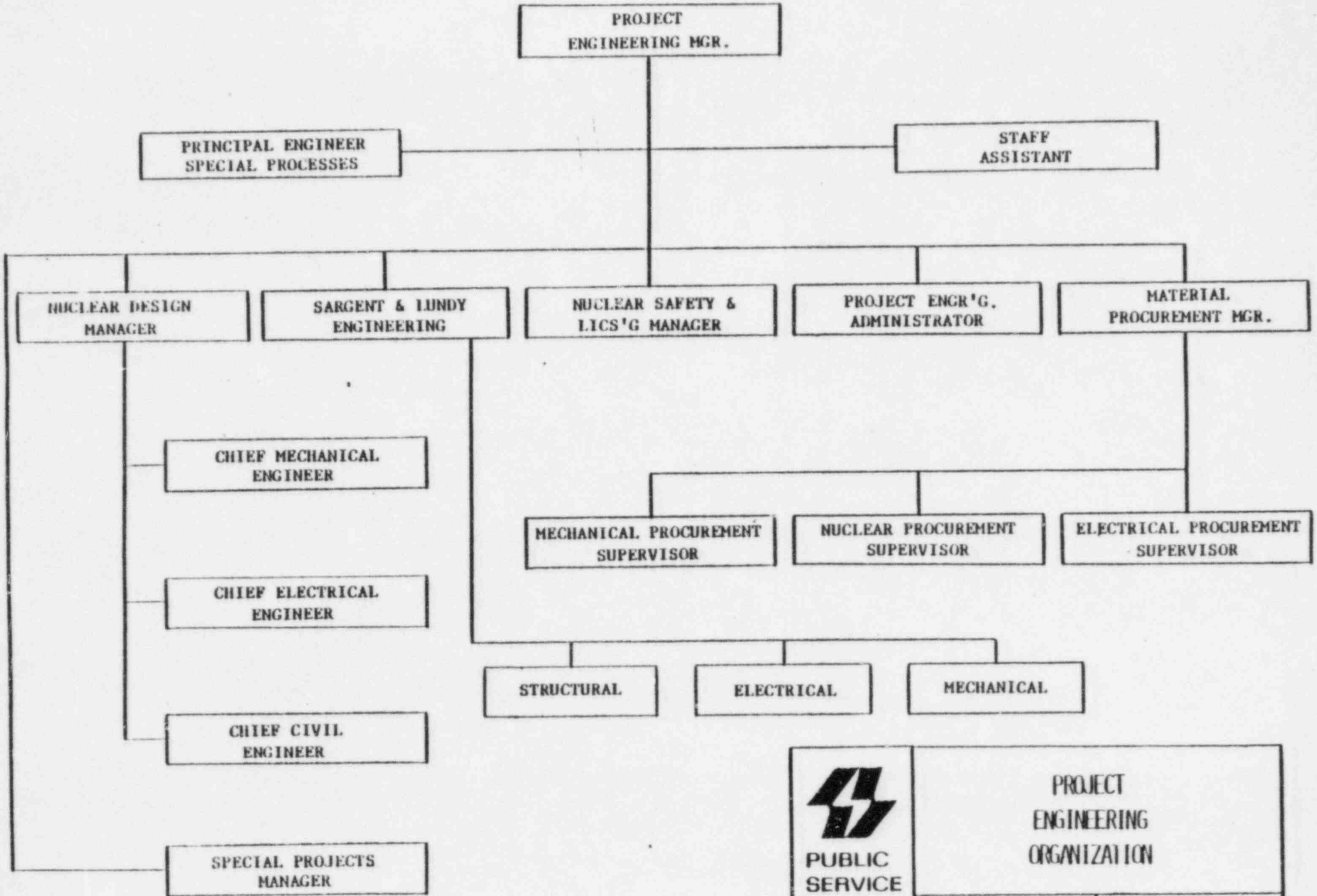
Quality trends evidenced by audit data are analyzed and presented to PSI executive management as described in Subsection 1.2.8.



PUBLIC SERVICE INDIANA

OVERALL
MARBLE HILL
PROJECT ORGANIZATION

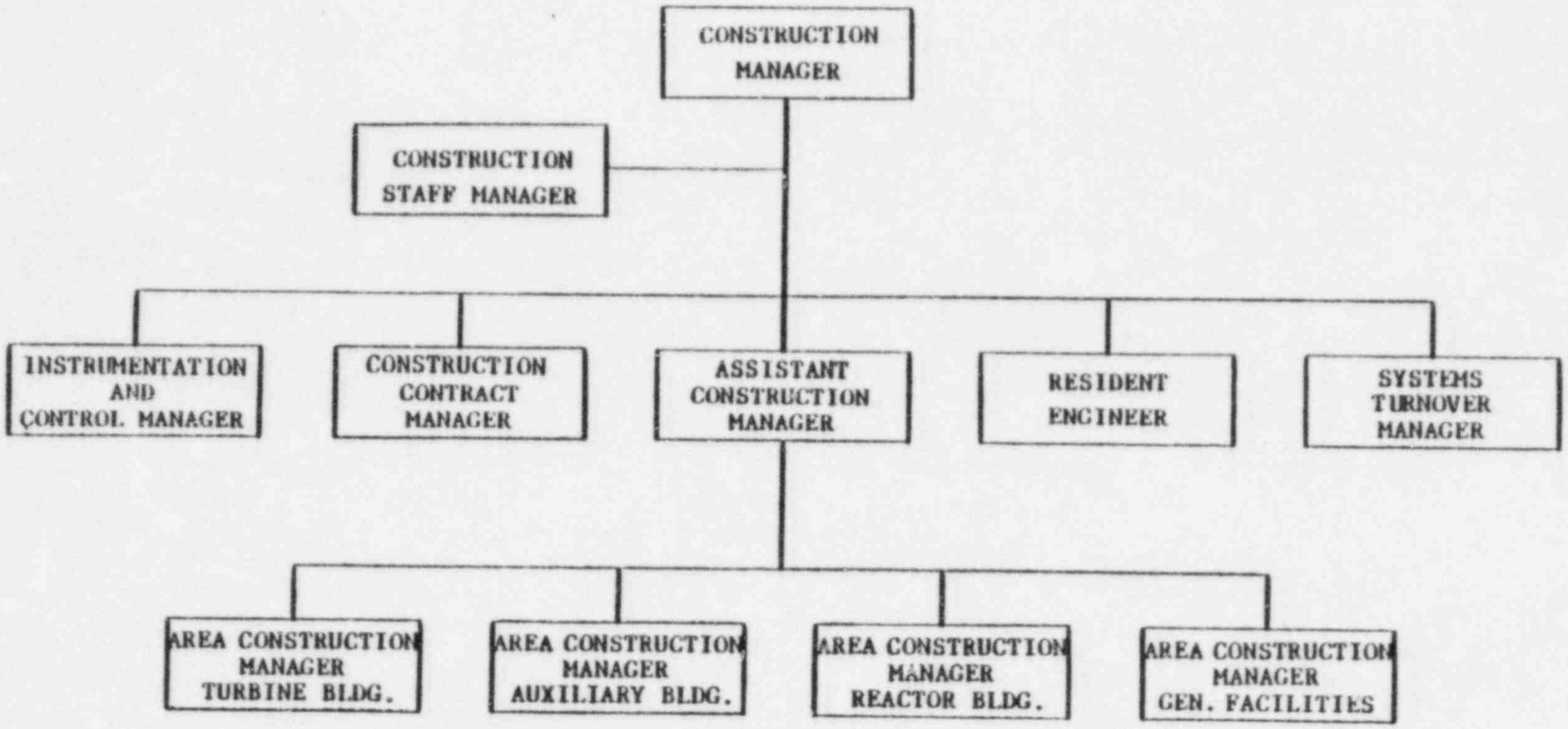
FIGURE 1-1 | AS OF 4-80



PUBLIC SERVICE INDIANA

PROJECT ENGINEERING ORGANIZATION

FIGURE 1-2 | AS OF 4-80

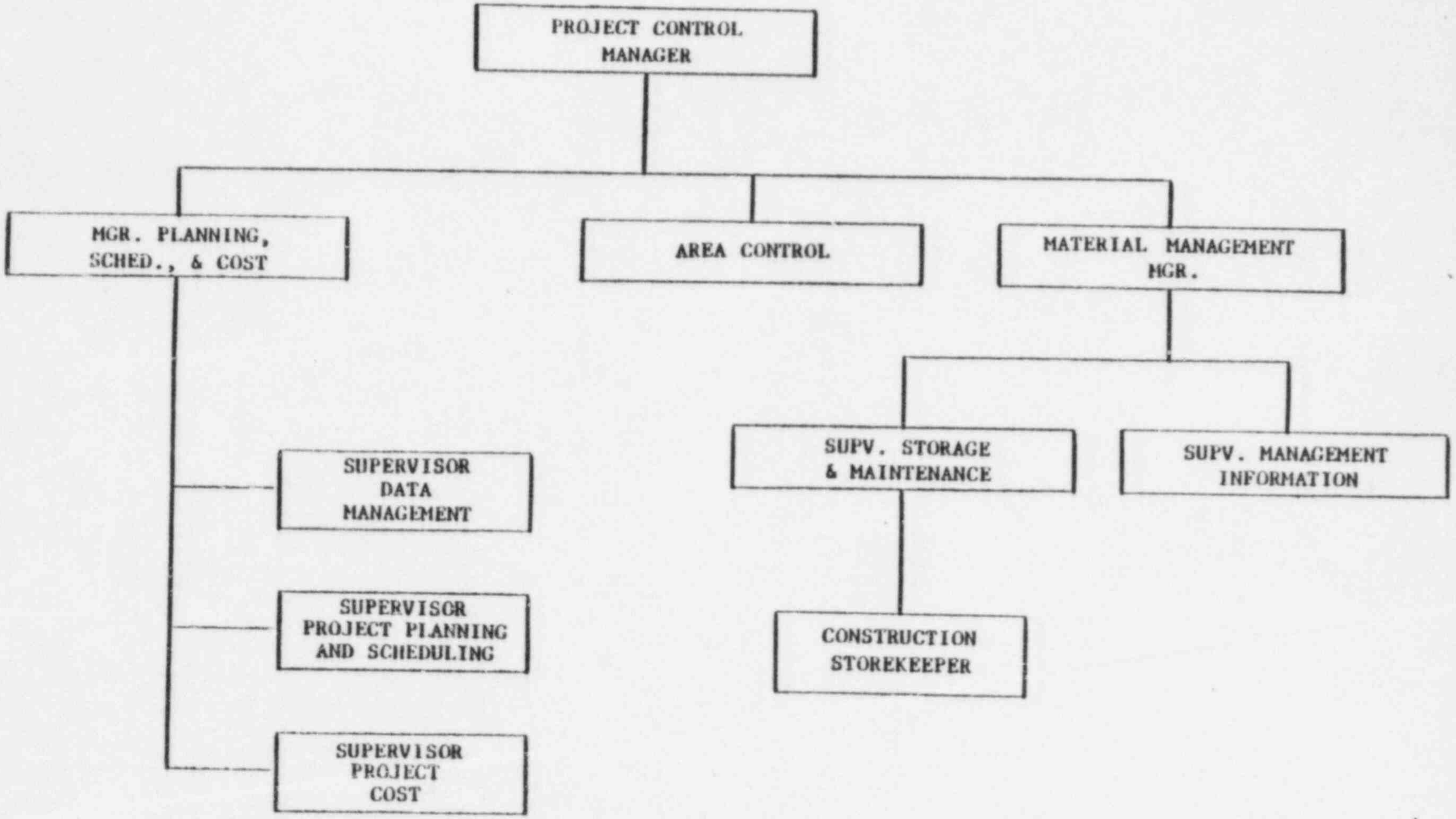


PUBLIC SERVICE INDIANA

PROJECT CONSTRUCTION ORGANIZATION

FIGURE 1-3

AS OF 4-80

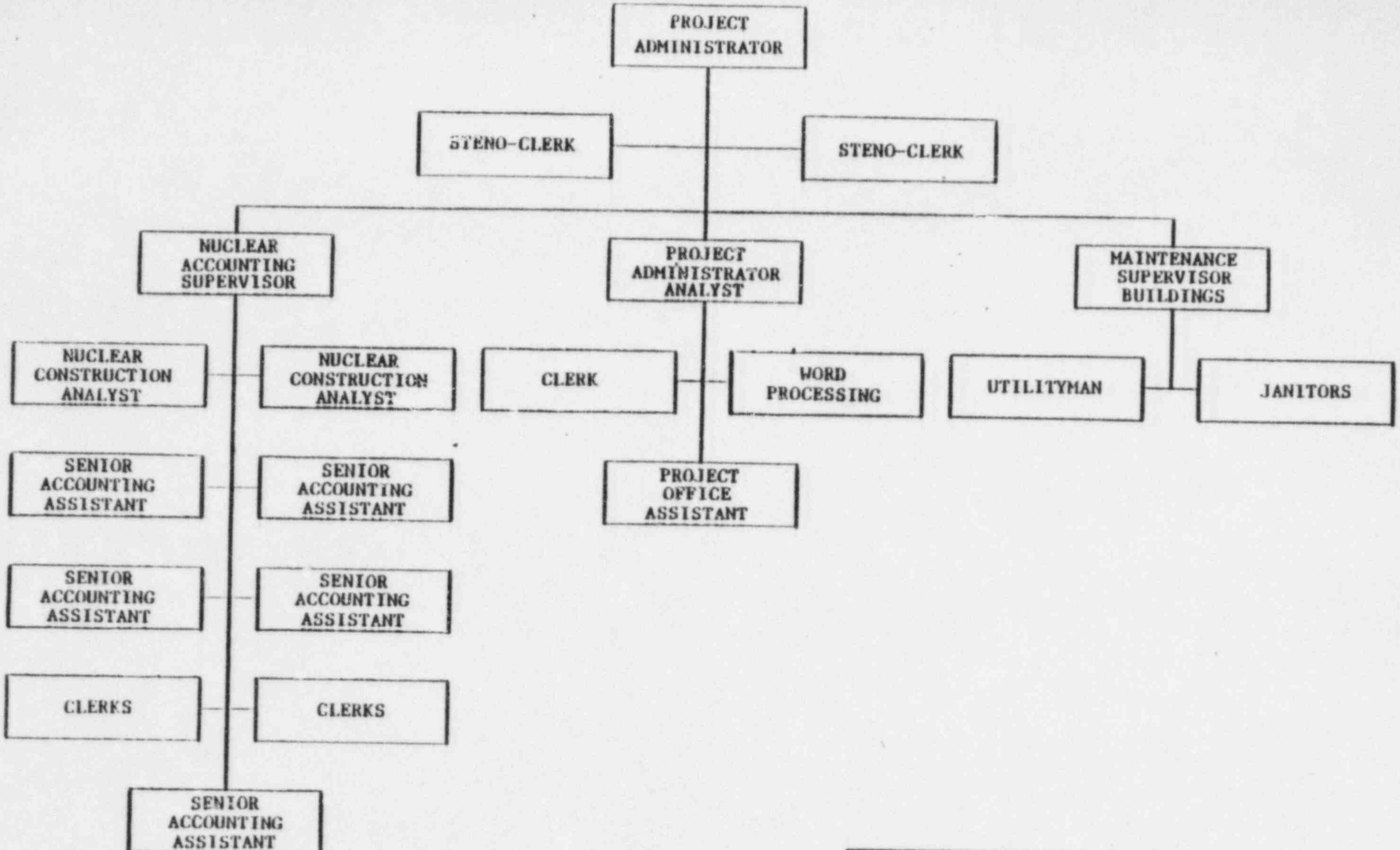


PUBLIC SERVICE INDIANA

PROJECT CONTROL ORGANIZATION

FIGURE 1-4

AS OF 4-80

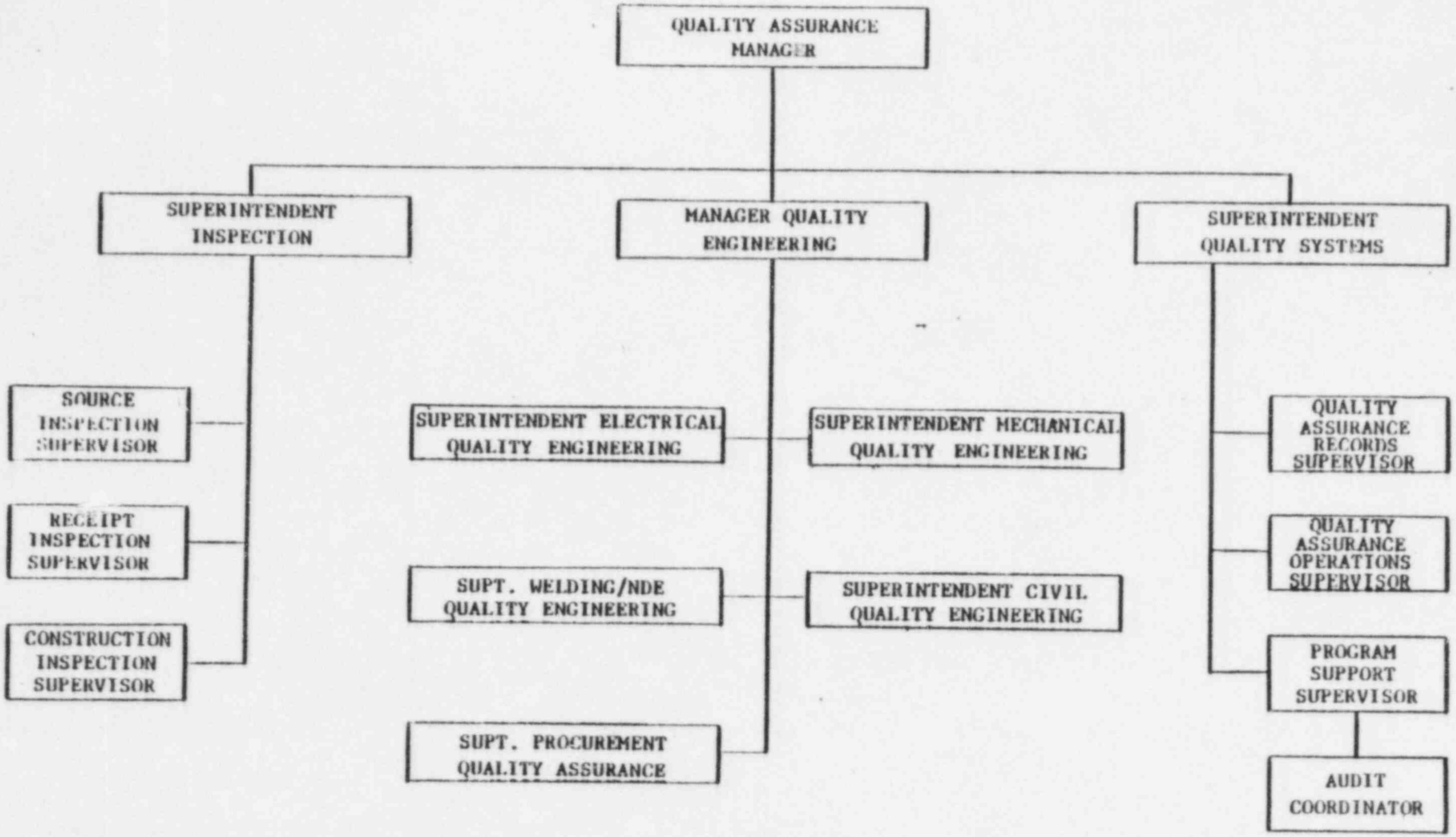


PUBLIC SERVICE INDIANA

PROJECT ADMINISTRATION ORGANIZATION

FIGURE 1-5

AS OF 4-80



PUBLIC SERVICE INDIANA

PROJECT QUALITY ASSURANCE ORGANIZATION

FIGURE 1-6 | AS OF 4-80

TABLE 1-1

QUALITY ASSURANCE MANUAL COMPLIANCE WITH 10 CFR 50, APPENDIX B

Quality Assurance Manual Sections 10 CFR 50, Appendix B Criterion

PQAM	AQAM		
i	i	Table of Contents	
	ii	Glossary of Definitions & Abbreviations	
Sec. 1.0	Sec. 1.0	Organization	I
Sec. 2.0	Sec. 2.0	Quality Assurance Program	II
Sec. 3.0	Sec. 3.0	Design Control	III
Sec. 4.0	Sec. 4.0	Procurement Document Control	IV
Sec. 5.0	Sec. 5.0	Instructions, Procedures and Drawings	V
Sec. 6.0	Sec. 6.0	Document Control	VI
Sec. 7.0	Sec. 7.0	Control of Purchased Material	VII
Sec. 8.0	Sec. 8.0	Identification and Control of Items and Material	VIII
Sec. 9.0	Sec. 9.0	Control of Special Processes	IX
Sec. 10.0	Sec. 10.0	Inspection	X
Sec. 11.0	Sec. 11.0	Test	XI
Sec. 12.0	Sec. 12.0	Control of Measuring and Test Equipment	XII
Sec. 13.0	Sec. 13.0	Handling, Storage and Housekeeping	XIII
Sec. 14.0	Sec. 14.0	Inspection, Test and Operating Status	XIV
Sec. 15.0	Sec. 15.0	Nonconforming Materials and Items	XV
Sec. 16.0	Sec. 16.0	Corrective Action	XVI
Sec. 17.0	Sec. 17.0	Records	XVII
Sec. 18.0	Sec. 18.0	Audits	XVIII
	Sec. 19.0	Authorized Nuclear Inspection	
	iii	Exhibits	

TABLE 1-2
PROJECT MANAGEMENT PROCEDURE CORRELATION WITH 10 CFR 50, APPENDIX B

SECTION NO.	PMP NO.	SECTION/PMP TITLE	10 CFR 50, APP.B CRITERION
1.0		GENERAL ADMINISTRATIVE PROCEDURES	
	1.00	Organization and Responsibilities	I
	1.01	Preparation and Control of Project	
		Project Management Procedures	II, V
	1.02	Project Correspondence	
	1.03	Project Files	XVII
	1.04	Training	II
	1.05	Project Directives	V
	1.06	Project Action Plan	
	1.07	Nonconformance Control	XV, VIII
	1.08	Security	
	1.09	Safety and Fire Protection Surveillance	
2.0		CONSTRUCTION MANAGEMENT PROCEDURES	
	2.00	Organization and Responsibilities	I
	2.01	Coordination of Contractor's Activities	
	2.02	Construction Housekeeping	
	2.03	Review of Contractor-Prepared Procedures	V
	2.04	Field Design Change Control	III
	2.05	Construction Status Reporting	
	2.06	Halting Construction Processes	XVI
	2.07	Construction Contract Documents	IV
	2.08	Award of Construction Contracts	VII
	2.09	Contractor Performance and Reporting	VII
	2.10	Contract Payments	

TABLE 1-2
PROJECT MANAGEMENT PROCEDURE CORRELATION WITH 10 CFR 50, APPENDIX B

SECTION NO.	PMP NO.	SECTION/PMP TITLE	10 CFR 50, APP.B CRITERION
	2.11	Construction Contract Changes	IV
	2.12	Contractor Relationships	
	2.13	Construction Acceptance of Systems and Structures	X, XI
3.0		PROJECT QUALITY ASSURANCE	
	3.00	Organization and Responsibilities	I
	3.01	Qualification and Certification of Quality Assurance Personnel	II
	3.02	Supplier and Contractor Qualification	VII
	3.03	Control of Quality Assurance Correspondence	VI
	3.04	Handling of NRC Inspection Reports	VI
	3.05	Control of Inspection/Surveillance Plans	X, XI
	3.06	Supplier Inspection and Surveillance	X
	3.07	Receipt Inspection	X, VII, VIII
	3.08	Site Construction Inspection and Surveillance	X
	3.09	Review and Approval of Supplier Procedures	V
	3.10	Stop Work Order	XVI
	3.11	Project Quality Trending and Corrective Action	XVI
	3.12	Quality Verification Records	XVII
	3.13	Audits	XVIII
	3.14	Control of PSI Measuring and Test Equipment	XII

TABLE 1-2
PROJECT MANAGEMENT PROCEDURE CORRELATION WITH 10 CFR 50, APPENDIX B

SECTION NO.	PMP NO.	SECTION/PMP TITLE	10 CFR 50, APP.B CRITERION
	3.15	Control and Use of Code Symbols	
	3.16	Qualification and Certification of NDE Personnel	IX
	3.17	A.I.A. Interfaces	
	3.18	File Control and Maintenance of PDPs and CDPs	VI
	3.19	Quality Assurance Training	II
	3.20	Follow-up Action on NCRs and CARs	XVI
4.0		PROJECT ADMINISTRATION PROCEDURES	
	4.00	Organization and Responsibilities	I
	4.01	Word Processing	
	4.02	Processing of Invoices	
	4.03	Extra Work Authorizations	IV
	4.04	Request for Local Purchases	IV
5.0		PROJECT ENGINEERING	
	5.00	Organization and Responsibilities	I
	5.01	Design Control	III
	5.02	Document Control	VI
	5.03	Preparation and Control of Procurement Documents	IV
	5.04	Administration of Procurement Contracts	IV, VII
	5.05	Design Activities "N"-Certificate Holder	III
	5.06	Design Activities As An Owner	III
	5.07	Preparation and Review of Certified Design Specifications	III

TABLE 1-2
PROJECT MANAGEMENT PROCEDURE CORRELATION WITH 10 CFR 50, APPENDIX B

SECTION NO.	PMP NO.	SECTION/PMP TITLE	10 CFR 50, APP.B CRITERION
	5.08	Preparation, Review and Approval of Design Reports	III
	5.09	Engineering Action Item Tracking	III, XV, XVI
	5.10	Review of NRC Inspection and Enforcement Bulletins	II
	5.11	Preparation and Revision of the FSAR	II
	5.12	Project Engineering Status Reporting	
	5.13	Field Job Orders	IV
	5.14	Preparation of the Environmental Report	
	5.15	Engineering Disposition of Nonconformance Reports	XV
	5.16	Special Process Procedures	
	5.17	Technical Manual Review	
6.0		PROJECT CONTROLS PROCEDURES	
	6.00	Organization and Responsibilities	II
	6.01	Material Management Program	XIII
	6.02	Receiving of PSI-Purchased Material	VII
	6.03	Storage, Handling and Maintenance of PSI Stored Material	XIII
	6.04	Unassigned	
	6.05	Material Management Information System	XIII
	6.06	Project Planning and Scheduling	
	6.07	Contractor Planning and Scheduling	II

TABLE 1-2
PROJECT MANAGEMENT PROCEDURE CORRELATION WITH 10 CFR 50, APPENDIX B

SECTION NO.	PMP NO.	SECTION/PMP TITLE	10 CFR 50, APP.B CRITERION
	6.08	Area Controls Support	
	6.09	Budget Preparation and Forecasting	
	6.10	Cash Flow	
	6.11	Change Order Estimating	
	6.12	Data Entry	
	6.13	Final Cost Report	
7.0		CONSTRUCTION TEST	
	7.00	Organization and Responsibilities	II
	7.01	System Turnover	X
	7.02	Area Turnover	X
	7.03	Master Punch List	XV
	7.04	Control of Construction Test Procedures	VI
	7.05	Test Execution and Completion	XI
	7.06	Construction Work Request	IV
	7.07	Scoping	
	7.08	Construction Test and Startup Plans	XI
	7.09	Construction Test Schedules and Reports	XI
	7.10	Test Instrument Calibration and Control	XII
	7.11	System Cleanliness	IX
	7.12	Qualification of Construction Test Personnel	II

TABLE 1-2
PROJECT MANAGEMENT PROCEDURE CORRELATION WITH 10 CFR 50, APPENDIX B

SECTION NO.	PMP NO.	SECTION/PMP TITLE	10 CFR 50, APP.B CRITERION
	7.13	Hold, Caution, and Test Status Tagging	XIV, VIII
	7.14	Quality Assurance During Construction Testing	XI
	7.15	Control of Systems During Construction Testing	XI, VIII, XIV
	7.16	Coordination of Vendor Serviceman	VII
	7.17	Control of Jumpers and Lifted Leads	XIV