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DENTON,H.R. Office of Nuclear Reactor Regulation, Director

SUBJECT: Summarizes 820301 meeting w/NRC to discuss design control program for facilities.Description of program & slides presented at meeting encl.Independent piping design review will be completed about 820601.

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APR 30 1982

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUSQUEHANNA STEAM ELECTRIC STATION
REPORT ON NRC STAFF MEETING ON MARCH 1, 1982
ER 100450 FILE 841-2 Docket Nos. 50-387
PLA-1074 50-388

Dear Mr. Denton:

This letter is sent to document the meeting between the NRC staff and PP&L on March 1, 1982. The purpose of this meeting was to discuss the design control program for Susquehanna. Attachment II is a copy of the slides presented during the meeting.

The Susquehanna design control program has been established to produce a high quality plant design that has inherently safe operating characteristics. A defense in depth strategy was employed to develop measures that assure quality, establish control, and provide verification. PP&L has been involved in all stages of the design process to insure that these measures result in the achievement of the design goals for safety and quality.

The design control program has been heavily influenced by the PP&L management style. This style permeates the entire organization and influences the way we conduct our affairs. We insist upon openness and frank disclosure of problems and issue with our employees, our contractors, the general public, and the regulatory agencies. We insist on remaining accountable for the actions of those who serve us. In maintaining this accountability, we find ourselves extensively involved in the activities of our contractors.

For over two years, PP&L's nuclear activities have been structured into a fully integrated and dedicated Nuclear Department which has one single objective, that is the construction and operation of our two nuclear units. This organization contains essentially all of the elements required to manage and control the design and construction of the plant

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and to sustain its operation once the units are placed in service. The organization is over 850 strong at this time and growing and it is our expectation that approximately 1,100 people will be in the organization by the time the second unit is complete.

PP&L has developed a program that meets regulatory requirements and is similar to ones used by other utilities. However, there are significant differences in the extent of involvement by our technical and quality organizations in all of the activities of our contractors. Attachment I contains a description of the elements of the design control program and further defines the PP&L involvement. In order to demonstrate the effectiveness of this program, PP&L has committed to conduct an independent piping design review in cooperation with the NRC. Details about this commitment have previously been sent to the NRC in my letter of March 16, 1982 (PLA-1039). We anticipate that this effort will be completed about June 1, 1982, and that it will show that our design control program has been successful.

Very truly yours,

N. W. Curtis
Vice President, Engineering & Construction-Nuclear

DPM/dmm

Attachments

cc: Mr. R. Purple
Mr. J. Knight
Mr. R. Tedesco
Mr. A. Schwencer
Mr. E. Jordan
Mr. R. Perch

ATTACHMENT I

DESIGN CONTROL AND VERIFICATION PROGRAM FOR SUSQUEHANNA STEAM ELECTRIC STATION

Susquehanna is PP&L's first and only nuclear power plant. Prior to making a nuclear commitment, the Company had significant experience in building fossil power plants and employed a variety of contractural arrangements to achieve construction of both oil and coal fired stations. This experience ranged from turn-key fixed price arrangements for design and construction to PP&L acting as its own construction manager. This varied experience led the Company to understand the need for design control measures and the demand for Company involvement to assure compliance with program goals.

PP&L developed an effective program of design control which has been an integral part of this project since its inception. This program has grown in response to an increasing degree of project complexity and expanding regulatory requirements. The fundamental features of this program have been established to achieve design quality, design control, and design verification.

Design Quality

High standards of design quality were established well before the project design was actually initiated. These standards were developed in order to assure that the Susquehanna design would be in compliance with the existing industry standards, regulatory guides, and NRC requirements. In addition, these standards established criteria for selection of contractors on the basis of their corporate philosophies on safety and quality, their past experience, and their staff competence.

PP&L has built a competent engineering organization of 90 people with approximately 470 manyears of nuclear experience to oversee the activities of our contractors. We are determined to stay involved with these activities, to participate in the decision process with regard to specifying designs and equipment, and to be accountable for the quality of the final product. With regard to plant safety characteristics, it has been and still is our intent to "go the extra mile" in the interest of obtaining a quality product and a plant that will operate safely and reliably.

Design Control

A quality design control program has been in place throughout the Project. PP&L has developed a program to provide the means of controlling the design process. This program is in compliance with 10CFR50, Appendix B. Special features of this program provide control which exceeds that required by the above regulatory documents.

The elements of this program include formal engineering and quality assurance procedures, checks and reviews of the design

process and documentation at many engineering and administrative levels, and several types of independent quality assurance audits. This program requires formal transmittal process. The design control program is governed by formal internal and contractor procedures which address all features of design inputs, control and verification.

Such procedures assure design control since they specifically identify (1) the methodology to be followed in all phases of design development, (2) appropriate interfaces that must be maintained, and (3) approvals required before going to the next phase. Adherence to these procedures is verified by PP&L and contractor QA auditing. Interdiscipline coordination is provided in the form of formal memos for data transmitted, group review logs, and a central control point for routing all information.

PP&L has authorized our architectural engineering firm (AE) to establish and maintain administrative control over all other contractors in the design process. This presents a unified point to maintain control over the range of procurement, technical review, quality control, and contract administration. This procedure has resulted in fewer coordination problems because there are fewer interfaces. It also facilitates resolution of problems and increases assurance that equipment and services are furnished as specified.

The design process and associated documentation is scoped by start-up system (SUS) which consists of a group of components and structures that can be start-up tested and turned-over as a unit. Engineers are assigned from the various disciplines to develop each SUS. One engineer is assigned to be the cognizant engineer for a SUS. Design information relevant to a SUS is automatically funneled to its cognizant engineer via the computerized configuration control program. This approach facilitates communications and minimizes interface problems.

The PP&L and contractor Quality Assurance (QA) programs assure compliance with design control procedures and formality. The PP&L program performs audits of PP&L and contractor activities. The AE has a project QA program to oversee its activities, and also has discipline QA/QC coordinators to review specifications, drawing, and calculations within each discipline.

In addition to the above special features of the design control program, PP&L has had a continuously active role in guiding the design development. PP&L jointly developed the conceptual design, in conjunction with the contractors. PP&L prepared the PSAR and FSAR from contractor input, but only after substantial internal review for adequacy in meeting design quality standards. In addition, PP&L has directly managed many technical programs, defined requirements, established technical and schedule objectives, and managed consultants with specialized experience in the investigation and resolutions of special tasks. PP&L's intense involvement has been demonstrated by our ability to

provide the majority of testimony at the ACRS meeting and ASLB hearing.

Examples of major efforts in which PP&L exercised technical leadership are as follows:

A. Containment New Loads Program

- o Development of KWU quenchers for improved steam suppression.
- o Development of plant-unique LOCA loads by full scale testing.
- o Leader of BWR Mark II Owners Group.
- o Preparation of the Susquehanna Design Assessment Report.

B. Equipment Qualification Program

- o Dynamic loads qualification of safety-related equipment to withstand seismic and hydrodynamic loads in accordance with the intent of current requirements.
- o Environmental qualification of Class I-E electrical eqiupment to meet the requirements of NUREG-0588, Category II. This is a significant effort requiring evaluation, testing, and some replacement of equipment.

C. Advanced Control Room Development

- o Directly in control of the design, fabrication, installation, testing and operation of this program.

D. Control Room Simulator

- o Made a decision to implement a duplicate control room simulator before operation. This was extremely useful for operator training and human factors evaluations.

E. Susquehanna Design Review Committee

- o Established a committee composed of PP&L and industry specialists who reviewed and evaluated the adequacy of plant design to withstand transients and TMI-type fuel damage. The committee found the plant to be adequately designed for the safety and protection of the public, but recommended improvements in the design of some systems, structures and equipment, primarily to improve operating efficiency and reliability.

All key decisions for the project have been made or reviewed by PP&L. These decisions have been based on corporate studies or recommendations from contractors. Examples include the approval

of all key drawings, specifications, design changes, personnel changes, and procurements.

Design Verification

An effective design verification program has been maintained by PP&L throughout the project. This program consists of design reviews by appropriate AE disciplines to confirm that the specified level of design quality has been achieved, that adequate design control has been maintained, and that adequate documentation exists for design substantiation. Following these reviews, design information is sent to the site to allow plant construction. Following construction, design information is assembled into Engineering Turn-Over (ETO) Packages and transmitted to the Integrated Startup Group (ISG), who is an independent group responsible for ETO review and acceptance.

The ISG reviews the ETO packages to ensure that adequate documentation has been provided to substantiate plant design and construction and to support plant operation, maintenance, and emergencies. This review serves as a "hold point" until ISG is satisfied that the ETO packages are complete. After acceptance, the ISG will provide verification of the design by checking out and starting up each SUS. This process provides assurance that the design and construction of systems are complete, and that equipment is correctly installed and performs as intended.

The next step in the design verification process occurs when ISG turns over the systems to another independent organization within PP&L. This is another "hold point" until this organization is satisfied with the design documentation and the levels of quality and control. Additional testing will be performed by them during the plant startup.

Throughout the design process, the QA programs of PP&L and our contractors have been persistently verifying that quality standards and control measures have been met. PP&L has not allowed our contractors to function free of PP&L participation. For example, PP&L has performed many audits specifically dedicated to verify the design control function. Many of these have included our own engineering staff or independent consulting engineering services to review the design and design processes in detail.

While the auditing process is characteristically viewed as looking backward, PP&L has also chosen to apply it to in-process construction and installation activities via unannounced audits which give no prior notification - in much of the same way as I&E of the NRC. These real time verifications require formal checklists and are conducted at a frequency of about 2-3 per week.

Further, PP&L formed a separate group to intensify our overview of the construction installation process. Part of this group function is verification of the design as-built. The group

verifies not only construction work, but also the many commitments for corrective actions. These must be performed in conjunction with I&E inspection findings and design and equipment changes which have been identified in conjunction with resolving reportable deficiencies. Therefore, when design, construction, or manufacturing deficiencies have been reported, PP&L has first hand assurance that the equipment installed is consistent with the revised design documents and regulatory commitments.

PP&L has played an aggressive role in controlling nonconforming conditions and equipment and situations which can trend towards a loss of control in the QA program. This is reflected in PP&L management's attitude towards having the AE consistently report nonconforming conditions. As of February 26, 1982 a total of 8,841 AE nonconformance reports have been issued.

Stop Work Actions have been exercised whenever circumstances dictate. In the history of the Susquehanna Project, PP&L has issued 113 deficiency reports, 13 of which have required stop work action. There have also been several situations where the QA organization has encouraged PP&L management to voluntarily stop work when conditions show evidence of the development of undesirable trends.

The PP&L QA program has been extensively supplemented with independent third party reviews. These reviews provide valuable insight into on the effectiveness of design control measures and the QA program. The attached table provides some detail on the major PP&L initiated reviews.

To assess the adequacy of safety-related piping design of Susquehanna, the NRC contracted with Battelle Pacific Northwest Laboratories to perform an independent design verification analysis of a sample of safety-related piping. The detailed results of this analysis are documented in a report entitled, "Susquehanna Steam Electric Station - Main Steam Safety Relief Valve Line "N" Piping Analysis," dated September, 1980. The conclusion in this report is summarized in the following statement, "This analysis verified that the sample (of) piping system met the applicable American Society of Mechanical Engineers Code requirements and confirmed the Applicant's ability to correctly model and analyze piping systems". Reference: Susquehanna Safety Evaluation Report, NUREG-0776, Paragraph 3.9.1, dated April, 1981.

In conclusion, we feel that an effective design control program is important. We have put forth much effort to develop measures that have enabled the Susquehanna design process to flow, but through a carefully determined path. While we have experienced our fair share of administrative and technical problems, we are confident that the controls have been effective. This confidence stems from the fact that PP&L has been extensively involved in the activities of our contractors. We have established strong interfaces with the AE and the NSSS vendor, which have facilitated the management of the project. Many means of design

verification have been employed to assure that our quality standards have been met or exceeded. Positive feedback has been received in the form of a high success rate in the pre-operational testing program. Therefore PP&L has confidence that its program of design control and verification has been effective and will produce a plant ready for operation.

Major PP&L Initiated Independent Third Party Reviews

Review Title and Consultant	Scope Description	Estimated Manhours	Cost
A. Quality Assessment of the Advance Control Room by EG&G-WASC, Inc. (1980)	An independent review of the engineering, documentation and project quality controls for the Susquehanna Advanced Control Room.	5000	$376K
B. Piping Analysis Methodology by Teledyne Engineering Services, Inc. (1979)	Teledyne Engineering Services was retained by PP&L to review the design process utilized by the AE in determining that compensating struts were required to provide protection for the "superpipe" region of piping systems at the Susquehanna Steam Electric Station.	500	$113K
C. Design Review of HVAC System Calculations by EDS Nuclear (1981)	HVAC Systems in Safety-Related and non-Safety-Related areas were reviewed for design adequacy to maintain specified temperature, pressure and flow conditions.	300	$ 24K
D. Safety System Walkdown by MPR Associates (1980)	Field walkdown and system evaluation to verify the adequacy of the design and construction of the following system: - RHR System (Loop B) - Core Spray System (Loop A) - High Pressure Coolant - Injection System	400	$ 26K

Major PP&L Initiated Independent Third Party Reviews

Review Title and Consultant	Scope Description	Estimated Manhours	Cost
	- Reactor Core Isolation Cooling System - Diesel Generator System - Station Battery Systems		
E. Intergranular Stress Corrosion Cracking by Failure Analysis Assoc., Inc. (1979)	An assessment of the integrity and performance expectations for the Recirculation Inlet Safety End to Thermal Sleeve connection	300	$ 27K
F. Safety Impact Review (2/1) by EDS Nuclear (1981)	Review to evaluate the success of the program to ensure that the failure of a non-safety-related item will not impact a safety-related item.	1100	$ 85K
G. Containment SRV and Chugging Load Definition by SRI International (1980)	An evaluation of the adequacy of the dynamic forcing function methodology and test verification developed for PP&L Quenchers by Kraftwerk-Union.	8925	$644K