

EVALUATION OF KG&E'S RESPONSE
REGARDING DESIGN VERIFICATION ACTIVITIES
WOLF CREEK 1

BACKGROUND

By letter from D. Eisenhut to G. Koester dated January 4, 1984, the NRC staff stated that it had been seeking additional assurances from applicants for operating licenses that the design process used in constructing their plant had fully complied with NRC regulations and licensing commitments. The staff noted that an Integrated Design Inspection was performed on Callaway 1 by the NRC Office of Inspection and Enforcement. Since Wolf Creek 1 was of similar design as Callaway 1, the staff stated it was considering whether this and possibly other factors may support a conclusion that the design process for Wolf Creek 1 had met NRC regulations and licensing commitments. To assist the NRC staff in making its decision with respect to Wolf Creek 1 the applicant was requested to provide the following:

- (1) a summary of the differences in the design process between Wolf Creek 1 and Callaway 1 (Callaway 1 and Wolf Creek 1 are both SNUPPS standard designs)
- (2) a discussion of the effect of these differences (item 1) on the applicants confidence that the design process for Wolf Creek 1 is at least equivalent to that for Callaway 1
- (3) a discussion of how applicable Callaway 1 Integrated Design Inspection report findings had been addressed for Wolf Creek 1
- (4) a discussion of the quality assurance program related to design which assured that the applicable design commitments were implemented at Wolf Creek 1
- (5) any other information which would support the conclusion that the design process for Wolf Creek 1 has been properly implemented.

A meeting was held on February 6, 1984 at Bethesda, Maryland between the NRC staff, KG&E and Bechtel to discuss the applicant's design process utilized at Wolf Creek 1.

KG&E's letter dated March 9, 1984 responded to the NRC's request for additional information regarding the design process for Wolf Creek 1 which is the subject of this evaluation.

EVALUATION

The staff has reviewed KG&E response of March 9, 1984. The associated evaluation is divided into four parts, SNUPPS Standard Design, Wolf Creek Specific Design, Callaway IDI Report Findings and Design Quality Assurance Program.

SNUPPS STANDARD DESIGN

a. Licensee Furnished Information

The SNUPPS standard design process involves a single generic design applicable to both Callaway and Wolf Creek units. The SNUPPS standard design concept applies to the Reactor (Containment), Auxiliary, Turbine, Diesel Generator, Fuel, Control and Radwaste Buildings, several external storage tanks, transformers and vaults, and is referred to as the Power Block. Design of the Power Block is based upon meteorological, hydrological, geotechnical, and seismological characteristics which envelope the two sites. Responsibility for the standard plant design has been assigned by Kansas Gas and Electric Company and Union Electric Company to the lead Architect/Engineer (AE), Bechtel Power Corporation. The two units utilize identical nuclear steam supply systems (NSSS) and turbine-generator systems furnished by Westinghouse and General Electric, respectively. The design of the standard Power Block, including related stress and seismic analyses, is by the lead AE, Bechtel. Bechtel is also responsible for design integration of the nuclear steam supply and turbine generator system, thus providing a single point of interface control between the AE and principal design contractors. The entire Power Block effort has, since project inception, been carried out under a full scope 10 CFR 50, Appendix B Quality Assurance Program. Utility review and administration of the standard Power Block design effort is coordinated through the SNUPPS Staff who are employees of Nuclear Projects, Inc. Responsibility for design of plant and site features outside the power block (e.g., Ultimate Heat Sink, ESW Pumphouse, excavation and backfill) is retained by the individual utilities.

Implementation of standard design and design commitments cited in the FSAR is accomplished through the development of standardized design criteria; system descriptions; P&IDs; logic and schematic drawings and detailed design drawings simultaneously issued to each site for installation and erection. Design details and features are supported by standard engineering analyses, calculations, verification testing and computer codes. Materials and equipment procured for each plant use the same standard specifications or material requisitions. Vendor generated drawings, process procedures and test specifications are also standardized and apply to both SNUPPS units. All design activity within the lead AE scope of work is accomplished by a Bechtel-SNUPPS project design team. Site liaison personnel are assigned by Bechtel to each site to assist in resolution of field problems, including disposition of selected categories of Nonconformance Reports (NCRs) and Field Change Requests (FCRs); however, there is essentially no Field Engineering activity performed at either site. Design activity is performed on a generic basis at the home office. This applies to all elements of design including piping layout, instrument tubing design, pipe support and conduit (except for lighting and communications) detailing, cable tray and support design and structural and rebar detailing.

The preceding description for the standard Power Block design applies to all design activities within the Power Block, regardless of safety classification.

Limited site-specific design features are contained within the Power Block. Mainly, these are in the form of instrumentation and controls for equipment located outside the Power Block. Elsewhere, nonstandard design features within the SNUPPS Power Block are limited to those resulting from resolution of field

problems and deficiencies. Control and resolution of field identified problems is accomplished through use of generic project procedures developed to assure that standardization of design is effectively controlled and that any required deviations are rigidly managed.

b. Staff Conclusion

Based upon the Callaway IDI of the SNUPPS Power Block and also based upon the preceding information, the Staff concludes that the Wolf Creek Power Block has been designed in compliance with NRC regulations and licensing commitments.

WOLF CREEK SPECIFIC DESIGN

a. Licensee Furnished Information

The standard Power Block comprises approximately 95% of the design work required for Wolf Creek. The Wolf Creek site specific design work accounts for the remaining 5%.

Safety-related design work which is Wolf Creek specific includes the Essential Service Water (ESW) pumphouse, the ESW pipes/ductbank corridor, the ESW Discharge Structure, the excavation and backfill for safety-related structures, the Ultimate Heat Sink and the 10 CFR 100 site investigation analyses. The delineation of major design responsibilities for these Wolf Creek-specific structures and analyses is:

- * Dames & Moore performed the geotechnical site investigations and established the design soil parameters for the design analysis by both Bechtel and Sargent & Lundy.
- * Dames & Moore assembled and reviewed historical and Wolf Creek specific meteorological data.
- * Bechtel designed the ESW Pumphouse, the ESW pipe/ductbank corridor and the cross-over reinforcements where the ESW pipes/ductbank pass over non-safety related underground facilities.
- * Sargent & Lundy designed the excavation and backfill for the Power Block structures, the ESW Pumphouse, and the ESW pipe/ductbank corridor.
- * Sargent & Lundy designed the Ultimate Heat Sink, including heat injection analysis and design of the basin, slopes, and dam.

The following lists the design organizations and their major responsibilities for both Callaway and Wolf Creek and shows that most of the two plants' design functions were performed by the same organizations:

<u>Design Activity</u>	<u>Callaway Organization</u>	<u>Wolf Creek Organization</u>
Power Block	Bechtel	Bechtel
ESW Components	Bechtel	Bechtel
Excavation and Backfill	Bechtel	Sargent & Lundy
Ultimate Heat Sink	Bechtel	Sargent & Lundy
Geotechnical Consultant	Dames & Moore	Dames & Moore
Meteorological Consultant	Dames & Moore	Dames & Moore

Beginning with the initial stages of the project, KG&E implemented administrative procedures for identifying and controlling both the design responsibilities and the design interface responsibilities among Sargent & Lundy, Bechtel, and Dames & Moore. Design responsibilities and design interfaces were coordinated through routine meetings, correspondence and teleconferences among KG&E and the three design organizations, as appropriate. Each design organization's design and interface responsibilities were documented by KG&E in written procedures. In addition, each design organization's scope of work and specific interface responsibilities with the other design organizations were documented in scope, design criteria, and report documents generated by each design organization.

Development of the Wolf Creek-specific design was accomplished in accordance with written and approved procedures to ensure the accurate translation of design basis and regulatory commitments into drawings, specifications and procedures. KG&E imposed design control requirements on each design organization performing safety-related work. Bechtel, Sargent & Lundy and Dames and Moore are required to perform their respective scopes of design responsibilities in accordance with written procedures. Each organizations' procedures, instructions and standards describe the design process and prescribe methods for the planning, performance, verification, internal interface, and release of design work and changes to design work.

In addition to the procedural controls implemented by each design organization, KG&E has implemented written procedures for the technical review of selected documents generated by the site-specific design organizations. At the direction of the KG&E Manager Nuclear Plant Engineering, a technical review is performed on designated lead documents, including design criteria, functional descriptions, drawings and specifications. The technical review considers operability and maintainability, compatibility between the SNUPPS design and the site design, inclusion of acceptance criteria for inspections and tests, and requirements imposed by plant operating equipment. Any comments generated as a result of the technical review are transmitted in written form to the responsible design organization for resolution and close out.

During the construction phase, changes in the Wolf Creek-specific design as a result of site interference problems, deficiencies, or material unavailability, are controlled in the same manner as described for the Power Block portion of Wolf Creek. Construction or startup proposed changes are documented in the

same standardized FCR, NRC and SFR forms, and in accordance with the same procedures as for the standard Power Block portion of Wolf Creek. The forms are transmitted to either Sargent & Lundy or Bechtel for resolution and disposition, depending upon the organization responsible for the design. Prior to approving a change to the design, Bechtel and Sargent & Lundy are procedurally required to check the change against the design bases, as documented in the PSAR and other design criteria documents. Both Bechtel and Sargent & Lundy were required to revise the FSAR, when affected, and to incorporate design changes into as-built documents, including design criteria specifications, construction specifications and drawings, and/or design compilation reports.

b. Staff Conclusion

Through a review of the preceding information the staff believes that KG&E established the needed interface controls which have ensured that the Wolf Creek site specific safety-related design activities were coordinated among the organizations performing those safety-related activities. However, to fully evaluate the design process for the site specific portion of the Wolf Creek design the staff requires the following information from the applicant:

- (1) Audit records or other documentation which verify that Sargent and Lundy had performed and updated the calculations needed to support the current ultimate heat sink design.
- (2) Audit records or other documentation which verify that Sargent and Lundy had maintained and updated the ultimate heat sink design criteria document/data and that this updated information had been properly coordinated with the other design interfacing organizations (i.e., Bechtel, Dames and Moore).
- (3) Audit records or other documentation which verify that Sargent and Lundy had performed adequate internal interdivisional coordination associated with the ultimate heat sink design.

CALLAWAY IDI FINDINGS

a. Licensee Furnished Information

Each Callaway IDI finding and unresolved item was evaluated for its applicability to Wolf Creek. Of the fifty numbered items in the Callaway Inspection Report, just four of these were concerned with specifics applicable only to the Callaway project. They had to do with "as-built" conditions, nonconformances, and procedural controls for Callaway. Had the IDI team looked at Wolf Creek they could have found similar nonconformances and procedures discrepancies, which potentially could have resulted in a finding or unresolved item. However, conceptually their resolution would have been the same because the same project controls and project management team are in place to deal with such situations. Therefore, corrective actions taken in response to the Inspection Report findings were generically applicable to both Callaway and Wolf Creek.

A meeting was held in Union Electric's corporate offices on January 27, 1984 to review the status of the resolution of all IDI items. Office of Inspection and Enforcement, Region III Office, Union Electric, Bechtel, SNUPPS Staff and KG&E personnel were in attendance. The status review indicated that the majority of the items had already been resolved. For those items yet outstanding a resolution plan was discussed and agreed upon. When all items are resolved, Region III plans to document the close out of the IDI in an Inspection Report.

In summary, the IDI on the Callaway was really an inspection of the SNUPPS Project design process and the conclusions drawn from the inspection apply to Wolf Creek activities as well as to those at Callaway.

b. Staff Conclusion

Based on the Callaway IDI and the preceding information, the staff agrees with the licensee that the Callaway IDI was also an inspection of the Wolf Creek design and the staff concludes that the Power Block has been designed in compliance with NRC regulations and licensing commitments. Note that all Callaway IDI report open items were closed out by Inspection Report Number 83-33.

DESIGN QUALITY ASSURANCE PROGRAM

a. Licensee Furnished Information

The QA controls described in PSAR Chapter 17.1 have been contractually imposed on the Power Block AE and NSSS supplier and, through them or through KG&E, passed on to all consultants, subvendors and subcontractors responsible for furnishing safety-related goods and services.

Sargent & Lundy and Dames and Moore were committed to and functioned under Appendix B QA programs. The Sargent & Lundy scope of work was limited to design and did not include any procurement responsibilities except for the generation of specifications. Safety related activities by Dames and Moore were limited in scope to field and lab testing and data assimilating and analyzing. The QA Program Manual and changes thereto for both organizations were reviewed and approved by KG&E.

As with Bechtel and Westinghouse, both Sargent & Lundy and Dames and Moore utilized procedures and management controls to ensure that the design process progressed in accordance with Appendix B requirements and good engineering practice. These controls were subjected to internal auditing by independent quality assurance groups within both organizations, with any adverse finding being brought to management attention for resolution.

Another important element of the design quality assurance program involves a program of coordinated SNUPPS/Utility reviews of key design features and AE generated design documentation. At the initial stages of the Power Block design, a review was undertaken by the SNUPPS Utilities and NPI/SNUPPS staff to identify key design documents requiring consolidated utility review. This review process was carried out by the SNUPPS Technical Committee which is made up of senior engineering representatives from each of the SNUPPS Utilities (Note: The SNUPPS Utilities from 1973 to 1979, the time frame during which the basic plant design configuration was established, consisted of Union Electric,

Kansas Gas and Electric, Kansas City Power & Light, Northern States Power and Rochester Gas and Electric, the last two having extensive experience in the design and operation of commercial nuclear power plants). This review process, described in SNUPPS Staff and Utility procedures, requires staff and utility review and approval of system descriptions, P&IDs, logic and schematic drawings, major equipment specifications and other key design documentation developed by the AE. Individual utility design review comments and concerns are reconciled through the SNUPPS Technical Committee review process. Subsequent to this review, consolidated comments and direction are furnished to the AE for resolution prior to release of the design document to the field. The generic review process is supplemented by Plant Review Group studies and assessments of selected design features of interest; e.g., human factors, inservice inspection access engineering and computer systems evaluation. (Note: The Plant Review Group consists of utility specialists selected for study of selected design features and topics and operates within the framework of the Technical Committee). Where required, utility capability is supplemented by design reviews and studies provided by outside consultants and technical specialists under contract to SNUPPS/NPI and/or KG&E. As an example, technical specialists were utilized to provide independent review and assessment of the auxiliary feedwater pump design and to provide expertise in the review of generic fire protection systems.

In addition to the Power Block design reviews, KG&E was also involved in the technical aspects of the Sargent & Lundy, Bechtel and Dames and Moore work through review of design documentation. Coordination and compatibility of design between the various design organizations was accomplished and controlled by KG&E.

The process of SNUPPS/Utility review of key design features and documentation is described in SNUPPS staff and in utility procedures and is subject to individual audit and surveillance by SNUPPS staff and by each utility QA organization. Audit findings have been systematically tracked through closeout resolution.

Independent utility verification of the management systems, design process, and interface controls utilized by the AE and NSSS supplier in the course of design of Wolf Creek Generating Station has, since inception, been provided by means of a preplanned program of QA audit and surveillance. Audits of Bechtel and Westinghouse design activity have been accomplished through the SNUPPS QA Committee (representing senior Utility/SNUPPS Staff QA personnel) and by the SNUPPS/NPI organization. These audits provide assessments of the design process in vital areas such as.....

- *SAR change control;
- *AE/NSSS design interface control;
- *Control of standard (Bechtel) design-oriented computer programs;
- *AI program for reconciliation of "as-built" data with final piping seismic analyses;
- *Design review and design change control programs;
- *Design feedback program (from operating nuclear plants)
- *NCR, FCR and SFR processing and control.

These audits have been supplemented by Quality Assurance Committee-initiated audits of major Bechtel and Westinghouse equipment subvendors such as Combustion Engineering (Reactor Pressure Vessel) and the Westinghouse Tampa (Steam Generator/Pressurizer) and Pensacola (Reactor Internals) Divisions. These audits, which supplement the routine Bechtel and Westinghouse subvendor audit effort, were initiated because of the importance and safety significance of the specific equipment and provide independent SNUPPS/Utility examination and assessment of principal designer/subvendor design interfaces.

The SNUPPS Project also has had a program of technical design audits since 1977. These audits are conducted by independent, off-project designer personnel and provide focused examination and technical evaluation of key design features of the standard Power Block design. This effort, established by the SNUPPS Utilities, is managed by the Bechtel Quality Assurance Project Manager and utilizes non-project, technical specialists from the various Chief Engineer staffs at the Gaithersburg office. Subject matter covered by these technical audits include:

- *Hanger and Pipe Support Design
- *Piping Stress Analysis and Calculations
- *Design of Pressure Relieving Devices
- *Seismic Analysis of the Reactor, Auxiliary and Control Buildings
- *HELBA (high energy line break analyses) Design Analyses

The audits provide examination of subunit design discipline interface and provide an independent verification of design calculations and analysis utilized in the design process. Findings, discrepancies or items of concern are reviewed and tracked through closeout.

KG&E has provided Utility QA monitoring of the Sargent & Lundy design process through audits which were conducted during the course of the activity. Specific areas covered during these audits included:

- *Establishment of Design Criteria
- *Design and Design Review Process
- *Sargent & Lundy Internal Auditing and Corrective Action System
- *Management Overview
- *Computer Program Certification

KG&E also performed numerous field and home office audits and surveillances of Dames and Moore during the course of their role as seismological/geotechnical/meteorological consultants. Examples of the scope of these activities are:

- *Meteorological Tower Instrument Maintenance and Calibration
- *Site Core Borings and Geophysical Testing
- *Investigation and Recording of Geological Features
- *Atmospheric Dispersion Calculations

The design assurance program described above has been in place since the start of design of the Wolf Creek Generating Station and is considered in full compliance with NRC regulations and standards.

b. Staff Conclusions

The staff concludes that the aforementioned information regarding design and construction quality assurance is in agreement with the quality assurance program description previously found acceptable by the staff.

SUMMARY

In the standard Power Block portion of the SNUPPS Plants, the staff finds that no differences exist in the design process. However, in the section entitled "Wolf Creek Specific Design" the staff requests additional information regarding the work performed by S&L. Subject to satisfactory review and evaluation of the requested information, the staff concludes that an independent design verification program is not necessary.

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