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OFFICE OF INSPECTION AND ENFORCEMENT

Division of Quality Assurance, Safeguards, and Inspection Programs

Quality Assurance Branch

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Licensee: Illinois Power Company
P. O. Box 678
Clinton, Illinois 61727

Facility Name: Clinton Power Station

Inspection At: Clinton Power Station, Clinton Illinois
Bechtel Power Company, San Francisco, California

Inspection Conducted: October 17-19, 1984

Inspection Team Members:

Program Director	J. Milhoan*, Section Chief, IE
Team Leader	G. Imbro, Senior Inspection Specialist, IE
Mechanical Systems and Mechanical Components	G. Overbeck, Consultant, WESTEC Services
Electric Power and Instrumentation & Control	C. Crane, Consultant, WESTEC Services
Civil and Structural	G. Harstead, Consultant, Harstead Engineering Assoc.
Horizontal Review	T. DelGaizo, Consultant, WESTEC Services
Quality Assurance	W. Belke*, Quality Assurance Specialist, IE
Site Visit Coordinator	R. Architzel**, Senior Inspection Specialist, IE

* Present at Bechtel, San Francisco
** Present at site

E. V. Imbro 10/31/84
Eugene V. Imbro Date
Team Leader, IE

Approved by: James L. Milhoan 11/1/84
James L. Milhoan Date
Section Chief
Quality Assurance Branch

INDEPENDENT DESIGN REVIEW (IDR)
OF CLINTON STATION

Program Plan Implementation Inspection Report

1. Background

On May 31, 1984, the Illinois Power Company submitted to the NRC a plan for an independent design review (IDR) of the Clinton Power Station. The program, to be performed by the Bechtel Power Corporation, was intended to provide the NRC with additional assurance that the design of Clinton was consistent with the design description of the Final Safety Analysis Report (FSAR) and the Safety Evaluation Report (SER) and its supplements. Subsequently, in a letter dated September 10, 1984, the NRC approved Revision 1 of the program plan as modified by Illinois Power in a letter dated August 22, 1984. During the week of October 15, 1984, a team of NRC inspectors visited both the Clinton Site and Bechtel Power Corporation to observe the implementation of the approved program plan and to review the status of the project.

2. Objective

The objective of the inspection was to ensure that the program was being conducted in accordance with the approved plan. The inspection included evaluations of the depth of vertical reviews being conducted by the IDR team, a review of walkdown activities, and discussions of documentation desired in the final IDR report.

3. Inspection Plan

The NRC's inspection was conducted in two phases, a site tour and an inspection of IDR progress at Bechtel's office. The site tour was conducted as an orientation for the NRC's inspection team of the systems being reviewed by the IDR. The site tour was also used to obtain information relative to the walkdown activities by the IDR team and to obtain technical input for the subsequent visit to the Bechtel office.

During the visit to Bechtel's office, the NRC team inspected IDR activities in the five major disciplines (mechanical systems, mechanical components, electrical, instrumentaion and control, and civil-structural) and also inspected horizontal review activities and quality assurance procedures in effect for the IDR. In each of these areas, the NRC inspectors concentrated on the implementation of the program plan, the depth of vertical reviews, walkdown activities, and resolving questions arising from the site tour.

ENCLOSURE

4. NRC Inspection Team

The NRC inspection team consisted of the following personnel:

Name	Assignment
J. Milhoan*	Program Director
G. Imbro	Team Leader
W. Belke*	Quality Assurance
T. DelGaizo	Horizontal Review
G. Overbeck	Mechanical Systems and Mechanical Components Disciplines
C. Crane	Electrical, Instrumentation and Control Disciplines
G. Harstead	Civil-Structural Discipline
R. Architzel**	Site Visit Coordinator

The NRC's discipline inspectors are registered professional engineers with substantial experience in conducting NRC Independent Design Inspections (IDIs).

* Present at Bechtel San Francisco

** Present at Site

5. Persons Contacted

The NRC's inspection team contacted a large number of individuals during this period. The following is a brief listing of the key individuals contacted either during the site tour or at the Bechtel office:

SITE

Name	Position
J. Geier	Ass't to Vice President, IP
D. Schopfer	S&L Field Project Manager
E. Hughes	IDR Walkdowns Coordinator - Bechtel

BECHTEL

Name	Position
P. Karpa	Mgr. of Engineering
C. Dick	Mgr. IDR Programs
G. Parkinson	IDR Project Manager

6. Summary of Conclusions

The discipline areas of mechanical systems, mechanical components, electrical power, instrumentation and control, and civil-structural were examined. Horizontal review activities, site walkdown activities, and project quality assurance were also inspected. In all cases, detailed reviews were being conducted by well qualified IDR personnel in accordance with the approved program plan and the associated implementing procedures.

There was evidence of substantial review of design calculations, piping and instrument diagrams, electrical diagrams, design specifications, structural drawings, and other design documents. In general, IDR review activities, as documented in observation reports, potential observation reports, requests for information, and project review sheets revealed a depth of vertical review sufficient to achieve IDR objectives.

Throughout the inspection Bechtel was cooperative, making available to the team all necessary documents and personnel. In addition to discussing the documents at hand, team members were able to follow-up on questions and areas of interest generated as a result of the site visit. The team was very favorably impressed with the magnitude of the Bechtel effort, the high caliber of engineering expertise being employed, and the obvious management commitment to the effort at the highest corporate levels.

While the NRC inspection team concluded that the IDR program plan was being adequately implemented, items were identified by the NRC inspection team as areas for IDR improvement. These items are identified in the attachments to this report. Programmatic comments refer to improvements in project procedures to ensure and document the objectivity of the IDR team's effort. Technical comments address areas for further technical review, which in the judgement of the NRC team, should be investigated as part of the IDR. In general, the technical comments were derived from the visit of the NRC team to the Clinton Site and also from the experience of the NRC inspectors on previous integrated design inspections conducted by the NRC Office of Inspection and Enforcement.

The NRC inspection was performed on a discipline basis. Where items identified for improvement appeared to cross discipline lines, these common items were identified to IDR management personnel at the exit interview and are listed below:

1. IDR procedures should be revised with respect to communications to ensure that requests for information from reviewee personnel (Ref: Item 2 of PROTOCOL) do not evolve into substantive discussions relative to the information obtained.

2. Clear guidelines should be established to ensure that the threshold level separating inconsequential deviations from potential observations is both understandable and consistent.
3. Observation reports should be written clearly and with sufficient technical detail to ensure that reviewee personnel as well as third party reviewers can fully understand the implications of the observation.
4. Further communication between discipline review groups should be encouraged.

7. Detailed Comments

Comments of the NRC's Inspection Team are provided on the attached area review summaries. Comments classified as programmatic should be addressed as soon as possible. Comments classified as technical need not be separately addressed, as long as the items are discussed in the final IDR report.

8. Nomenclature

The following nomenclature is used throughout the attachments to this report:

Applicant	Illinois Power Company
NRC inspection team	As per paragraph 4 above
IDR team	Bechtel Power Corporation personnel engaged in the IDR
Reviewee organization	Appropriate design organization (normally Sargent & Lundy)

9. Attachments

The following materials are attached to this report:

Attachment 1	Programmatic Comments
Attachment 2	Technical Comments
Attachment 3	Horizontal Review
Attachment 4	Quality Assurance

PROGRAMMATIC COMMENTS

The NRC inspection was performed on a technical discipline basis. NRC inspector comments address both technical matters and also issues related to the conduct of the IDR program and procedures. In order to separate the NRC's technical comments from comments of a programmatic nature, the programmatic comments have been listed in this attachment. Technical comments are listed by discipline in Attachment 2.

Observation Threshold

Observation. IDR project review sheets indicate a potential for inconsistency regarding the threshold level above which a design deficiency is classified as an observation or potential observation. Furthermore, minor design discrepancies not classified as observations may collectively indicate a trend relating to the design process, even though the individual deficiencies may be inconsequential as to adequacy of the design.

NRC Comment. IDR project procedures should provide clear guidelines for determining the threshold between inconsequential discrepancies, such as minor calculational math errors, and observations or potential observations. The review sheets should be reexamined considering these threshold guidelines. Prior to the final report, the completed review sheets should be examined as a package for implications related to design process trends indicated by those deficiencies not classified as observations or potential observations.

Discussions with Reviewee Organizations

Observation. In identifying potential problem areas, it is often necessary to obtain information from the reviewee organization. In fact, a project procedure (Procedure #3) indicates that an observation or potential observation report should not be written without discussions with reviewee personnel to insure that the IDR reviewer fully understands the design requirement. While understanding design requirements or obtaining technical information is necessary for preparation of an observation report, there is a possibility that these conversations could lead to discussions of substantive matters in violation of the established protocol. Even more significantly, there is a potential for reviewee personnel to convince IDR reviewers that there is no problem or that the problem is very minor. This can result in premature disposition of a

potential observation.

NRC Comment. IDR procedures should permit obtaining factual information from reviewee personnel. At the same time, these procedures should clearly identify protocol requirements relative to discussions of substantive technical matters with reviewee organizations. Substantive discussions of technical matters with reviewee personnel should be prohibited until after a potential observation report has been prepared and the reviewee organization has been given an opportunity to respond to the potential observation in writing. This procedure may yield an increased number of invalid potential findings but is necessary to guard against the possibility of premature disposition of a valid observation. The reexamination of review sheets in light of threshold guidelines discussed above should identify any potential observations which may have been prematurely dispositioned prior to revision of these procedures.

Out of Scope Items

Observation. It was not clear as to when the IDR team would not pursue a potential problem because of scope restrictions or when such a review would be forced into the scope, by investigating a similar item within the boundaries of the scope.

NRC Comment. Project procedures should be made clear as to the management level making decisions relative to scope questions, as well as basic guidelines or policy regarding prosecution of potential problem areas which exceed scope restrictions.

Project Review Sheets

Observation. Project review sheets are essentially the IDR reviewer's work sheets. As such the level of detail, particularly with regard to references or cross-referencing to other review sheet items, varies from reviewer to reviewer.

NRC Comment. Project review sheets are an important source of information in evaluating the depth of the IDR. As such, they should be consistent in the level of detail provided in them, particularly with regard to providing reference information or cross-referencing to related observations. The IDR procedures should address how consistency between review sheets will be assured.

TECHNICAL COMMENTS

Mechanical Systems and Mechanical Components Discipline

The following mechanical areas were reviewed: mechanical process, piping stress, pipe supports, and ultimate heat sink. In all areas, detailed reviews were being conducted by well qualified personnel in accordance with the program plan and implementing procedures. The IDR team was evaluating the Clinton design for design requirements, design adequacy, and the design process. Review activities were documented on review sheets in acccordance with Project Procedure #2. These review sheets, along with potential observation reports, observation reports, and requests for information, formed the basis of the NRC team's evaluation.

There was evidence of substantial review of design calculations, piping and instrument diagrams (P&IDs), design specifications, and supporting design documents. Details of the review activities indicated a depth of vertical review sufficient to achieve IDR objectives with regard to design adequacy and conclusions relative to the effectiveness of the design process.

The following items were identified by the NRC team as areas for IDR improvements:

Ultimate Heat Sink

Observation. The IDR team reviewed the design calculations for the ultimate heat sink. The calculation provided by the reviewee organization was performed for a two-unit site (since Clinton was originally designed for two units). The IDR team concluded that the calculations sufficiently demonstrated the adequacy of the ultimate heat sink in meeting design requirements, particularly in view of the existing design margins when considering that Clinton is now a one-unit site. In view of the inherent conservatisms of the calculation, the IDR team performed a somewhat limited review. This review however, does not provide meaningful information relative to the adequacy of the design process.

NRC Comment. In order to evaluate the design process relative to the ultimate heat sink, the ultimate heat sink design should be evaluated from the standpoint of the two-unit site. Primary design considerations should be fully evaluated, such as the initial temperature of the cooling lake at the start of an accident and the considerations of

spent fuel in the fuel pool. Calculations which develop the initial lake temperature and spent fuel pool heat input should be fully evaluated, including appropriate assumptions and methodology. Finally, worst case meterology should be technically evaluated.

High Energy Line Break

Observation. In the area of high-energy-line break (HELB), it was noted that very little had been done by the reviewee organization prior to the April 1, 1984 cut-off date for the IDR. In view of this situation, the IDR team was performing some independent analyses in order to determine whether or not design commitments were met.

NRC Comment. In view of the design status in this area prior to the IDR cut-off date, it does not appear that the IDR team is in a position to perform a meaningful independent review of reviewee activities in this area prior to the reviewee completing its high energy line break analysis.

Circulating Water Screen House

Observation. During the tour of the Clinton Site, the NRC team noted that the supply of make-up water to the shutdown service water system was through non-safety-related traveling screens with a back-up source through a non-safety-related sluice-gate in the intake structure (screen house). The Clinton FSAR states that loss of the ultimate heat sink is not a credible event. Nevertheless, after discussions with the IDR team, the basis upon which the design of the intake structure assures the availability of make-up water to the shutdown service water is not clear.

NRC Comment. The design of the intake structure should be further investigated to assure that design commitments have been met and that a reliable supply of make-up water to the safety-related shutdown service water system is provided by this design.

Electrical Power and Instrumentation & Control Discipline

The following electrical and I&C areas were reviewed: electrical power distribution, physical walkdown and separation, I&C logic, devices and setpoints, seismic qualification, environmental qualification, cable raceways, and calculations. IDR engineers performing the reviews were highly competent and experienced. The

average experience level of the six engineers interviewed was over 23 years. In general, the review effort was judged to be detailed and reasonably complete. In most areas, the level of detail of the review and the quality and depth of review were impressive and sufficient to achieve IDR objectives. The following items were identified as areas for IDR improvement:

Electrical Power

It was observed that an extensive review of the class 1E ac power distribution system had been performed. Single line drawings, metering and relaying drawings, isolation schemes, load shedding, thermal overloads, schematics, and penetrations and coordination curves were reviewed. The review sheets appeared to be complete and were based on a review of the FSAR commitments. Electrical separation was checked by the IDR team and all circuit breakers which required a protection trip on receipt of a LOCA signal were designed as required. Also, redundant circuit breakers were used in the design to protect containment electrical penetrations. Thermal overload protection was used on class 1E motor operated valve actuators; however, the devices were bypassed under all conditions except testing and maintenance. This design conformed to commitments.

Observation. The description and significance of some electric power observation reports appear to be understated. For example, Observation Report #06 states that calculations are needed to ensure that safety-related 460V motors and MOV operators will perform adequately. It further stated that the significance was that potentially the design process has not been adequately met. This fails to show the potential design deficiency that the safety-related 460V continuous duty motors and MOV operators may not be capable of performing their safety-related function due to inadequate starting characteristics. Another example of understatement was seen in Limitorque Report 80058 discussed under environmental qualification.

NRC Comment. The level of detail in the observation reports needs to be expanded to explain the deficiency more clearly as well as the significance of the technical issue.

Physical Walkdown

The electrical walkdown used a checklist which addresses as built concerns, and electrical separation. The walkdown checklist does not have a stated objective and

appears to be basically a selective inspection. The plant walkdown focused on the following areas: control room, cable spreading room, switchgear room, diesel generator areas, manholes, screen house, containment and drywell.

Observation. Specific circuits and associated conduit and tray runs were not checked to demonstrate the validity of design of a complete circuit (e.g., a power feeder from a motor control center to a valve inside drywell).

NRC Comment. Selected circuits should be inspected over the entire length to ensure all aspects of the design are reviewed.

Observation. Section II-4 of the walkdown checklist did not address separation distance between barriers (e.g., flex steel conduit) and wiring external to the barrier. This criteria is required by GE spec. 22A7472.

NRC Comment. The walkdown did not appear to examine separation aspects in PGCC panels, floor sections (e.g., smoke detector circuits), and local panels. A walkdown of these areas should be conducted to assure separation criteria are met.

Environmental Qualification

Observation. The potential observation report on Limitorque Report 80058, motor operated valves, appears to be understated in light of OR#06. Reduced voltage testing was not conducted and there is no evidence that the motors are oversized to produce sufficient torque to operate the valves under reduced voltage and accident conditions.

NRC Comment. Since Observation Report #06 shows the potential for a reduced voltage situation, 460V Limitorque valve operators should be qualified for operations under reduced voltage situations. This comment emphasizes the need for further intradisciplinary communication within the IDR team.

Observation. Terminal blocks inside containment and motors did not appear to be addressed in the environmental qualification review.

NRC Comment. These areas should be addressed in the IDR or Bechtel should provide appropriate justification.

Civil-Structural Discipline

The following civil-structural areas were reviewed: the circulating water screen house, the diesel generator building, expansion anchors, block walls, tornado missiles, buried piping, cable-tray and conduit supports, HVAC ducts, and pipe whip restraints. IDR engineers performing the reviews were highly experienced and technically competent. In most areas, the level of detail of the reviews was judged to be sufficient in detail and depth to adequately support IDR objectives. The following items were identified as areas for IDR improvement:

Circulating Water Screen House

Observation. The screen house structural steel was reportedly seismically designed to Uniform Building Code (UBC) requirements.

NRC Comment. Since the screen house provides the intake path from the cooling lake to the safety-related shutdown service water system, the effect of the screen house structural steel on the Seismic Category I reinforced concrete structure should be covered in the IDR to assure FSAR commitments have been implemented. Traceability of design information should be emphasized.

Component Support Design

Observation. Request-for-information #70 addressed FSAR paragraph 3.8.3.4 which required the mass of the support to be 2.5 times the mass of rotating equipment. The reviewee's calculation showed the mass of diesel generator supports to be 1.96 times the mass of the equipment. The reviewee's response was that the FSAR should have required a 1.5 to 1 ratio rather than a 2.5 to 1 ratio.

NRC Comment. A potential observation report should have been prepared for this item based upon design commitments as of the IDR cutoff date. In addition, this item should be further evaluated relative to its implications for adequacy of the design and design process.

HORIZONTAL REVIEW

The status of the horizontal review was investigated in detail. Project procedures established for conduct of the horizontal review were evaluated, as well as progress to date in implementing these procedures. The NRC team noted that all of the inspection reports identified in the program plan (e.g., the INPO report on Clinton, the NRC IDI report of Byron, etc.) had been reviewed and items applicable to Clinton had been identified. In addition, the NRC team noted that additional IDR commitments such as the Illinois Power initiatives and the Stone & Webster recommendations had been included in the horizontal review. While not strictly a horizontal review activity, it was also noted that the IDR was proceeding with the program plan commitment to evaluate design work performed by Reactor Controls, Inc. (RCI) with regard to the control rod drive piping design.

In all areas, the horizontal review was observed being performed in accordance with the program plan and implementing project procedures. Several items were traced by the NRC team from the horizontal review into the systems review within the IDR team. No discrepancies were noted. Even where review items were possibly beyond the scope of the Clinton IDR (such as a Byron IDR finding regarding loads on the 125V dc battery), the IDR team was observed to be pursuing the matter to a conclusion for the Clinton design. The IDR team considered the 125V dc battery question to be within the scope of the IDR review since the 125V dc system supports the 1E ac electrical distribution system which is within the scope of the Clinton IDR.

The NRC team discussed with IDR management personnel the need for specific documentation in the final report relative to the horizontal review. No areas of improvement or revision to IDR program procedures were noted during the course of this inspection relative to horizontal review activities.

QUALITY ASSURANCE

The quality assurance program established by Bechtel for the Clinton IDR was reviewed in the following areas: the IDR Procedures Manual, program documents, organization, quality assurance personnel, design control procedures, and audits. The Bechtel Quality Assurance Engineer has been with Bechtel Quality Assurance for 10 years, has been a quality assurance supervisor for 4 years, and is well qualified to perform his project duties. Quality assurance reporting relationships were adequate and provide the necessary degree of independence from the performing organization.

Upon completion of the NRC team's inspection, it was concluded that the Clinton Quality Assurance Program Plan is being implemented in a satisfactory manner. Procedures have been reviewed and approved by Bechtel's QA organization, as required. Monitoring and audit activities for the design process and document control areas are also being performed to assure proper implementation of established quality assurance practices.