ENCLOSURE 1

Revision 0

AUGMENTED INTEGRATED DESIGN INSPECTION

TECHNICAL AUDIT

AUDIT PLAN

WATTS BAR NUCLEAR PLANT, UNIT 1

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TECHNICAL AUDIT
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PURPOSE:

To assess the adequacy and implementation of the design, construction, and inspection processes and the adequacy and implementation of corrective action programs (CAPs). Performance of this audit will satisfy the commitment in the Nuclear Performance Plan, Volume 4 to perform an Integrated Design Inspection type audit at WBN prior to fuel load.

GENERAL:

The audit will focus on a nuclear safety related system that has been accepted, or near acceptance, by the operating staff. The boundary of this audit will include the support systems and portions of other systems and structures required to maintain functionality of the system under review. Additional components, structures or plant features may also be included as necessary to ensure comprehensive coverage. The audit will verify that:

- System descriptions/design criteria adequately reflect licensing commitments and regulatory requirements.
- System design is consistent with the design criteria, appropriate components and materials are specified and important design aspects are supported with technically adequate calculations.
- Installation (configuration, equipment, components, materials) is consistent with drawing and specification requirements.
- Operating, surveillance and maintenance procedures agree with design basis, vendor requirements, and technical specifications.
- Industry concerns, such as represented in Nuclear Experience Review (NER) items, NRC NUREGs, NRC Bulletins, SQN Lessons Learned, etc., have been correctly addressed in design documents, installation requirements, operating and maintenance procedures, as appropriate.

SCOPE AND APPROACH:

The audit will assess the design and functionality of the selected system through a review of the design implementation process and review of interfaces between design, construction, operations and maintenance.

Engineering:

Review the design basis documents and related documents such as calculations and analyses for the selected system to determine the functional requirements for the system and each active component during normal, accident or abnormal conditions. Based on this review, determine if:

- The design basis is in accordance with licensing commitments and regulatory requirements.
- The requirements of the NSSS vendor have been adequately addressed in the design.
- The design basis, analyses, and associated design output documents (e.g., drawings, procurement documents) are technically adequate.
- The system can function as specified by the design basis documents.
- System operation is consistent with design basis documents.
- The as-installed system configuration and physical supporting features are in agreement with the as-built design documents.
- Applicable NER items, NUREGs and NRC Bulletins have been appropriately incorporated into design documents, engineering and construction procedures/specifications.
- QA Records (drawings, calculations, etc.) are readily retrievable and legible.

Mechanical Design:

The Mechanical review will consist of a review of specific design activities related to the selected system such as operating modes calculations, HVAC calculations, pipe whip/restraint, flooding, water spray, environmental qualification, equipment qualifications, failure modes and effects analysis, single failure analysis, and operability/availability analysis for compliance to regulatory requirements.

A review of the FSAR, Technical Specifications, System Design Basis Document, Design Criteria, interface requirements, calculations, NSSS vendor inputs, responses to NRC Generic Letters, IE Bulletins, NER items, SQN Lessons Learned will be conducted to identify the mechanical system design requirements and regulatory commitments as they relate to the selected system and components.

The design documentation will be reviewed to ensure that the system operating limits, temperatures, pressures, flow rates, normal operating and accident conditions are consistent with the licensing basis and have been correctly reflected in calculations, equipment purchase specifications, operating and maintenance procedures and technical specifications.

The reviewer will determine that the methods used to comply with the design and regulatory requirements are adequate and address issues including:

The ability of components to function under accident conditions such as Appendix R, pipe break, pipe whip, seismic, water hammer and other internal and external hazards as defined in the licensing basis.

The effect on the system due to failure of non-seismic components and structures.

The effect on system operations due to Unit 2 components has been adequately addressed in the design.

The effect of manual actions and resulting time limits on system operations and manpower availability have been evaluated as part of the design.

The implementation of Appendix R safe shutdown components have been properly selected and are adequately defined and that the selected components are properly protected and maintenance requirements for barriers have been addressed.

The fire hazards analysis and design drawings accurately depict components required for shutdown and fire areas/fire zones.

Adequate engineering requirements or system limitations have been provided to other design organizations and/or plant operations/maintenance organizations.

Interface requirements from other design organizations have been properly incorporated in the design.

The design assumptions are reasonable and have been verified where appropriate.

The design documents and supporting analyses are consistent with standard engineering practices and the results are reasonable and adequate.

The design drawings provide adequate detail regarding critical attributes such as valve position/orientation, pressure boundaries, etc.

Electrical and I&C

The Electrical and I&C review will evaluate a review of specific design activities related to the selected system such as; ampacity, voltage drop, under/over voltage analysis, breaker coordination, battery sizing calculations, separation, component environmental qualification, set points and scaling calculations, loop error, valve timing, failure modes and effects analysis, single failure analysis, and operability/availability analysis for compliance to regulatory requirements.

A review of the FSAR, Technical Specifications, System Design Basis Document, Design Criteria, interface requirements, calculations, NSSS vendor inputs, responses to NRC Generic Letters, IE Bulletins, NER items, and SQN Lessons Learned will be conducted to identify the electrical system design requirements and regulatory commitments as they relate to the selected system and components.

The design documentation will be reviewed to ensure that the system operating limits, voltage, amperage, loop errors, valve timing, and normal and accident operating conditions are consistent with the licensing basis and have been correctly reflected in calculations, equipment purchase specifications, testing documents, operating and maintenance procedures and technical specifications.

The reviewer will determine that the methods used to comply with the design and regulatory requirements are adequate and address issues including:

Design calculations demonstrate adequate diesel capacity and proper load sequencing.

Adequate primary and secondary power and control sources.

Ability to function on loss of offsite power.

Design analysis accounts for system under voltage/over voltage.

Breaker coordination is provided for main and branch circuits including molded case breakers and fuses.

Design accounts for installed conditions such as proximity to hot pipes.

Electrical separation is provided for in raceway systems, cabinets and enclosures and complies with licensing requirements.

Raceway systems, and equipment grounding is adequate and grounding system integrity is maintained and tied to the station grid.

The design adequately addresses items as: separation for Appendix R, spurious operations due to associated circuits and AC actuation of DC components, and remote shutdown outside the control room.

The design accounts for components that are required to be de-energized to prevent inadvertent or spurious operation and that the methods of de-energization maintain component qualification such as seismic qualifications for racked out breakers.

Components have the ability to function under accident conditions such as Appendix R, seismic and other internal and external hazards as defined in the licensing basis.

Electrical power cables have been evaluated for derating due to fire barrier installation and that spray due to sprinkler actuation has been addressed.

The effect on the system due to failure of non-seismic components and structures.

Adequate engineering requirements or system limitations have been provided to other design organizations and plant operations/maintenance organizations.

Interface requirements from other design organizations and NSSS vendor have been properly incorporated in the design.

Design assumptions are reasonable and have, where appropriate, been verified.

The design documents and supporting analyses are consistent with standard engineering practices and the results are reasonable and adequate.

The design drawings provide adequate detail regarding critical attributes such as raceway positions/orientation, cable marking, instrument line slope, etc., and that the engineering inspection and testing requirements are complete.

The design provides for adequate environmental and seismic component qualification under normal and accident conditions.

The design provides proper interface inputs to supporting disciplines for items such as raceway supports and equipment mounting limits and equipment loads.

The design accounts for balance of plant support systems such as control air and that the Unit 2 systems required for Unit 1 operation are identified and designed to support Unit 1 operation.

The cable management system and electrical penetration management program are adequate.

Area electrical heat loads have been maintained and interfaced with HVAC design.

The design accounts for loop errors under both normal and accident conditions and that the set point and scaling documents reflect the output form the calculations, including items such as valve operator timing.

The design outputs provide adequate information to operations and maintenance such that operating or maintenance requirements are consistent with the design basis and that design margins are identified.

Civil /Structural

The Civil/Structural review will consist of a review of specific design activities related to the selected system such as: structural systems seismic design, component seismic qualification, structural load tracking, raceway loading, cut re-bar, penetration tracking systems, pipe stress and support design and analysis for compliance to regulatory requirements.

A review of the FSAR, Technical Specifications, System Design Basis Document, Design Criteria, interface requirements, calculations, NSSS vendor inputs, responses to NRC Generic Letters, NRC Bulletins, NER Items, and SQN Lessons Learned will be conducted to identify the civil/structural system design requirements and regulatory commitments as they relate to the selected system and components.

The design documentation will be reviewed to ensure that the normal and accident operating conditions are consistent with the licensing basis and have been correctly reflected in calculations, equipment purchase specifications, testing documents, operating and maintenance procedures and technical specifications.

The reviewer will determine that the methods used to comply with the design and regulatory requirements are adequate and address issues including:

Design addresses conditions such as pipe whip, jet impingement, heat shields due to hot pipes and other internal and external hazards as defined in the licensing basis.

The design accounts for the effect on the system due to failure of non-seismic components and structures.

Adequate engineering requirements or limitations have been provided to other design organizations and/or plant operations/maintenance organizations, such as temporary pipe loading limits for shielding are accounted for, raceway load limits, seismic restraints for scaffolding and other movable items, etc.

Interface requirements from other design organizations and NSSS vendor have been properly incorporated in the design.

The design assumptions are reasonable and, where appropriate, have been verified.

The design for the piping system accounts for generic issues such as IGSCC, MIC, erosion/corrosion and that this information has been properly accounted for in the analysis and plant ISI program.

The design documents and supporting analyses are consistent with standard engineering practices and the results are reasonable and adequate.

The design drawings provide adequate detail regarding critical attributes such as pipe support positions/orientation, anchorage, line slope, etc.

The design provides proper interface outputs to supporting disciplines for items such as raceway support limits and equipment mounting limits and equipment loads.

Adequate methods are in place to maintain configuration control and design margin control for items such as floor loading, cut re-bar, penetrations, load tracking inside containment, support loads, etc.

The installed conditions are consistent with pipe stress analysis and pipe support analysis, equipment seismic qualification, etc.

The design properly accounts for small bore/large bore pipe and tubing interactions.

Construction:

The construction review will consist of a review of specific design activities related to the selected system such as: installation is consistent with design outputs, installations properly addressed design tolerances and installation procedures accounted for engineering design test and acceptance criteria.

A review of the Design Output Documents, Design Basis Documents, Design Criteria, specifications, installation procedures, vendor manuals and NSSS vendor installation requirements etc., will be conducted to identify the construction requirements and regulatory commitments as they relate to the selected system and components.

Based on team preliminary system walkdown and review of the design drawings, specific installations and components will be selected for field verification for compliance to design and installation requirements.

The commodities to be verified are to include: piping, piping components, and supports; Electrical raceways (cable, cable trays and supports, conduit and supports, junction boxes, grounding, etc.); instruments, instrument lines and supports.

Review design output documents, specifications, EQ Binders, procedures and vendor manuals pertinent to the installation/ commodities and establish attributes to be field verified. The attributes are to consist of both configuration attributes (routing, location, slope, separation, etc.), and detail physical attributes(connection details, weld size, materials, member sizes, etc.)

Perform field verifications of the attributes selected. Utilize quality control inspectors where appropriate. In instances where attributes cannot be visually verified in the field (e.g., material type) determine from documentation that the attribute has been previously inspected and accepted.

During assembly of documentation to support installation, procurement, etc., determine that QA Records are readily retrievable and legible.

Operations:

The operations review will consist of a review of specific design outputs related to the selected system such as set point and scaling documents, master fuse list, operating modes, Tech Spec inputs, temporary modifications, lifted leads programs, SI and Testing program, operating procedures, valve line-up, primary and critical drawings for compliance to regulatory requirements.

A review of the FSAR, Technical Specifications, System Design Basis Document, interface requirements, NSSS vendor inputs, primary and critical drawings and SER Supplements will be conducted to identify the system design requirements and regulatory commitments as they relate to the selected system and components.

The design documentation will be reviewed to ensure that the normal and accident operating conditions are consistent with the operating documents and have been correctly reflected in operating procedures, technical specifications, training and testing documents.

The reviewer will determine that the methods used to comply with the design and regulatory requirements are adequate and address issues including:

Applicable NER items, SQN Lessons Learned, etc., have been appropriately incorporated into procedures.

Lifted leads program, work control, temporary modifications programs are consistent with maintaining the design basis.

The procedural steps will achieve required system performance for normal, abnormal, remote shutdown, and emergency conditions.

Procedures adequately address the most limiting design basis event. (Where it is not reasonable to provide detail guidance, determine that the training program ensures operator knowledge in the areas of concern).

That the training simulator and program is current with plant conditions.

Procedure steps for remote operation of equipment can be performed under the environmental conditions assumed during accident conditions, including maintaining communications with the control room.

The training manual and lesson plans are technically accurate.

Manual action requirements are achievable within the time limits established for proper system operations and that adequate area lighting for both access and operations is provided.

The degree of training is consistent with amount of technical detail in the procedures. In particular, that operators are trained on system response, failure modes, and required actions involved in the credible scenarios in which the system is required to function.

Tag out procedures are adequate to maintain system status.

Component labeling and tagging is consistent with the drawings and procedures.

Maintenance:

A review of the EQ binders, NSSS and vendor inputs, NER Items, SQN Lessons Learned, vendor manuals, maintenance procedures, and Tech Specs will be conducted to identify the system design requirements and regulatory commitments as they relate to the selected system and components.

The design documentation will be reviewed to ensure that the normal and accident operating conditions are consistent with the maintenance documents and have been correctly reflected in the maintenance procedures and technical specifications.

For key components of the system, review the associated maintenance procedures to determine if:

> Procedures are sufficient to perform the maintenance task and provide for identification and evaluation of equipment deficiencies.
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> Procedure content is consistent with the latest, approved vendor manuals and drawings.

Materials used to perform maintenance is consistent with the design and vendor requirements.

Applicable NER items, etc., have been appropriately incorporated into procedures.

Maintenance personnel are adequately trained on procedures.

Surveillance Testing:

A review of the FSAR, Technical Specifications, System Design Basis Document, NSSS vendor inputs, responses to NRC Generic Letters, and NRC Bulletins will be conducted to identify the system requirements and regulatory commitments as they relate to the selected system and components.

The documentation will be reviewed to ensure that the normal and accident operating conditions are consistent with the operating documents and have been correctly reflected in Surveillance Instructions (SIs), Training, and testing documents.

Review the surveillance test program to determine if:

The procedures are consistent with the FSAR and Technical Specifications.

The acceptance criteria is consistent with the design outputs and is adequate to demonstrate continued operability.

The test and acceptance values will demonstrate functionality under the conditions as intended by the Technical Specifications and comprehensively address the required system functions.

Audit Team

The Audit Team will function under the direction of the Watts Bar Nuclear Assurance Organization. The team will be composed of TVA and outside consultants. Team members will have independence from the Watts Bar Site activities being audited.