ENCLOSURE 1

WATTS BAR NUCLEAR PLANT

HEATING, VENTILATING, AND AIR CONDITIONING (HVAC) DUCT AND DUCT SUPPORTS

Corrective Action Program Plan

Revision 0

WATTS BAR

TVA NUCLEAR

WATTS BAR NUCLEAR PLANT

HVAC DUCT AND DUCT SUPPORTS

CORRECTIVE ACTION PROGRAM PLAN

REVISION 0

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HVAC DUCT AND DUCT SUPPORTS
CORRECTIVE ACTION PROGRAM PLAN

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CORRECTIVE ACTION PROGRAM PLAN

1.0 INTRODUCTION

Stop Work Order number 11 was issued in April 1981 because safety-related HVAC piping and ductwork were installed without a documented quality assurance program. Quality Assurance for HVAC piping and ductwork supports was provided; therefore, supports were excluded from the Stop Work Order scope. The corrective actions for this issue focused on developing and retrofitting a quality assurance program to the existing installations. This Stop Work Order was lifted and these corrective actions were completed prior to 1985. Subsequently, additional deficiencies have been identified as defined herein.

This Corrective Action Program (CAP) Plan describes the program for resolving deficiencies, some of which have been determined to be significant, involving structural qualification of safety-related HVAC ducts and associated supports at Watts Bar Nuclear Plant (WBN). These deficiencies have been identified in Conditions Adverse to Quality Reports (CAQRs), Nuclear Regulatory Commission (NRC) violations, and Employee Concerns. The deficiencies identified are categorized as follows:

- Discrepancies in design basis.
- Design output did not envelop all design parameters.
- Installed configurations that do not comply with design documents.
- Discrepancies between installed configurations and inspection documentation.

The root causes of these deficiencies exist in both engineering and construction activities. The following root causes address in order, the four deficiencies identified above.

- Incomplete design criteria in that several critical attributes were not addressed or correctly accounted for. This was due in part to inadequate control and documentation of engineering judgment.
- Engineering did not completely implement the design criteria and did not perform an adequate design review in some cases.
- Fragmented and unclear or inadequate installation requirements.
- Unclear inspection requirements.

2.0 OBJECTIVE

The objective of this CAP is to assure that the WBN unit 1 safety-related (Category I and I[L]) HVAC duct and duct supports are structurally adequate and in compliance with licensing requirements and design criteria. Revisions will be made to the design criteria and to the Final Safety Analysis Report (FSAR) to ensure compatibility of the design criteria with the licensing requirements. Licensing commitment changes will be proposed only when technically justified.

3.0 SCOPE

This CAP covers the structural qualification of safety-related (Category I and I[L]) HVAC duct and duct supports required for unit 1 operation which are not within the scope of the Hanger and Analysis Update Program (HAAUP). HAAUP's scope consists of piping/tubing used in the HVAC system which is qualified by rigorous or alternate analysis techniques in accordance with design criteria WB-DC-40-31.7.

4.0 PROGRAM DESCRIPTION

4.1 Program Phases, Major CAP Elements, and Evaluations

TVA will perform an engineering evaluation of safety-related HVAC duct and duct support installations required for unit 1 operation. Known deficiencies, which will be resolved under this CAP, are listed in Attachment 1. A flowchart and fragnet for the work are illustrated in Attachments 2 and 3, respectively.

The CAP plan consists of the following actions:

- Complete and document the design basis.
- Update the design output documents to be consistent with the completed design basis.
- Revise construction, maintenance, and QA procedures to incorporate design output requirements.
- Develop and implement a critical case evaluation of existing installations with corrective actions as appropriate. The number of critical cases to be evaluated will depend on the assessment of walkthrough data.

The four parts of the CAP plan are described in the following sections.

4.1.1 Complete and Document the Design Basis

The existing HVAC duct and duct support design criteria (Reference 1) will be reviewed for technical adequacy and agreement with the FSAR and other licensing commitments. The design criteria and FSAR will be revised as required to establish a complete and technically adequate design basis. Licensing commitment changes will be proposed when technically justified.

Calculations have been identified which are required to support the above design criteria. These calculations are identified in Section 5 of Reference 1. Development of the calculations will support the WBN essential calculation activity described in the Design Baseline and Verification Program (DBVP).

4.1.2 Update Design Output Documents

Existing HVAC duct and duct support designs will be reviewed for correctness and completeness and revised as necessary to bring them into compliance with the design criteria. It is likely that some new duct and duct support design drawings will be issued to provide additional details for typical installations.

An Engineering Requirements Specification (ER Spec) will be issued to define structural requirements for HVAC ductwork and support installation.

4.1.3 Revise Implementing Procedures

After issuing the ER Spec, construction, maintenance, and QA implementing procedures will be reviewed and revised as necessary to ensure proper implementation of engineering requirements.

4.1.4 Develop and Implement a Critical Case Evaluation of Existing Installations

Because of the problems identified in the design, construction, and inspection of duct and duct supports, TVA will perform a critical case evaluation of the installed safety-related HVAC duct and duct supports required for unit 1 operation.

Definition of Critical Cases

Existing HVAC duct routing and support locations are shown on output documents; however the specific location of hardware (e.g., grills and dampers) is not indicated on the design output documents for all cases. Additionally, the duct supports specified on the routing drawings are referenced to typical support designs. Output documents showing HVAC duct routing and support locations will be screened to identify HVAC designs for critical case consideration.

During original construction, deviations from typical support configurations were documented on Support Variance Sheets (SVS). Since there have been several CAQs identifying discrepancies between installed configurations and the SVS documentation, the accuracy of such documentation must be verified. Therefore, an engineering walkthrough to address those issues, as well as the other identified deficiencies, will be implemented.

This engineering walkthrough will consist of a review of installed safety-related HVAC duct and duct supports by engineering personnel who will focus on those attributes essential to HVAC duct and duct support qualification. Parameters such as duct spans, spacing of anchor bolts, and cantilever length of free ends will usually be screened based on visual examination. Actual measurements will be taken when necessary. The engineering walkthrough will be performed by teams of engineering personnel familiar with the HVAC duct and duct support design basis for WBN. These teams of engineering personnel will be trained to identify critical cases based on the following:

- Installed conditions for which the engineering screening identified design criteria deviations.

- Installed conditions determined to be sensitive to the identified types of installation deficiencies by the engineering screening.

- Installed conditions resulting from variances to original designs which are sensitive to installation deficiencies.

Random, independent reviews of the engineering walkthroughs will be performed to assure adequacy of the critical case selections. The review will be performed by engineering personnel qualified to the same requirements as members of the original walkthrough team.

In addition to the evaluation of critical cases discussed above, obviously unacceptable installations such as missing anchor bolts will be documented and corrected.

Implementation of Critical Case Evaluations

Critical cases identified and sketched by walkthrough teams will be grouped and categorized and further reviewed to determine the final critical cases for evaluation which envelop the total population of HVAC duct and duct supports. The as-built configuration for the final critical cases will be verified by Nuclear Quality Assurance (NQA). It is expected that most of the final critical cases will be evaluated analytically, although testing may be utilized.

Subsequent to the evaluation of the final critical cases, those critical cases that do not meet the design criteria will be reviewed and unacceptable attributes will be identified. These particular attributes will then be reviewed for the entire population with field modifications implemented as required.

For further details of the critical case evaluation program, see Exhibit A.

4.2 Recurrence Control

Recurrence control actions are provided to address the root causes. The specific steps involved in recurrence control are as follows, in order corresponding to the root causes noted in Section 1.0:

° Revision and maintenance of the Design Basis Document per Nuclear Engineering Procedure (NEP) 3.2.

NEP 3.1, "Calculations" and NEP 3.2, "Design Input" are now in place requiring documentation to support engineering judgment. No further actions are required for this item.

° Training to the revised design criteria will be conducted, and strengthened engineering procedures (NEPs), which require an independent design verification of methods used, are now in place.

° Issue of the ER Spec as a single document for structural requirements pertaining to the installation, maintenance, and inspection of HVAC duct and duct supports.

Revise implementing procedures to incorporate applicable ER Spec requirements.

Training to revised implementing procedures will be conducted.

° Recurrence control for the unclear inspection requirements will be the same as the previous item.

4.3 Licensing Assessment

In order to explicitly include structural qualification requirements in the FSAR, appropriate seismic damping values and allowable stresses or loads will be established. A technically justified FSAR revision will be submitted to NRC to update damping values. Development of these updated damping values will be done under the Seismic Analysis CAP. Also, FSAR Section 3.7.3.5.1 states that the peak spectral acceleration will be used if the component is rigid. The use of spectral accelerations will be clarified.

Any other changes identified in licensing documents will be handled as specified in Section 4.1.1 in accordance with the requirements of the DBVP.

5.0 PROGRAM INTERFACES

For the purposes of this CAP, two types of program interfaces are considered: production and programmatic. Production interfaces are those interfaces with other programs where one program's output impacts the scope of another program, but does not impact program methodology. Programmatic interfaces with other programs are those interfaces where one program's methodology or progress is contingent upon or at risk with respect to the results of another program.

5.1 Production Interfaces

° HAAUP - HAAUP Program will address the portion of the HVAC systems analyzed using the piping analysis and support design criteria.

5.2 Programmatic Interfaces

° DBVP - The HVAC duct and duct support design criteria is a portion of the Design Basis Document output by DBVP.

° Seismic Analysis CAP - Will provide input into this CAP with respect to seismic parameters.

° QA Records Program - The documentation resulting from this program will be used to demonstrate the adequacy of the existing configurations.

° Equipment Seismic Qualification Program - Will handle qualification of in-line and attached equipment.

6.0 PROGRAM IMPLEMENTATION

The plan will be implemented by Nuclear Engineering (NE), Nuclear Construction (NC), and NQA. Additionally, Nuclear Maintenance (NM) will be affected by revised NE output. The specific responsibilities are as listed below:

° NE is responsible for the issue of revised design criteria, revised design output, walkthrough procedures and their implementation, calculations, testing, overall coordination of programs, and the final report.

° NC is responsible for revising any NC procedures required to implement NE output, providing support to NE during the engineering walkthrough, and performing any required modifications.

° NQA and Engineering Assurance (EA) will perform audits and reviews to ensure the effectiveness of program activities and deliverables. Additionally, NQA is responsible for verification of as-built data gathered on the critical cases selected for evaluation and for revising any QA/QC procedures required to implement revised NE output.

° NM is responsible for revising any maintenance procedures required to implement revised NE output.

7.0 PROGRAM DOCUMENTATION

The CAP plan activities will be performed in accordance with approved instructions or procedures. Field data will be gathered in accordance with approved WBN walkthrough procedures which will specify the documentation requirements. Calculations generated during this program will be performed and documented in accordance with applicable NEPs, and Watts Bar Engineering Procedures. Any items in the evaluation program

that do not meet design criteria (e.g., cannot be qualified in as-installed configuration) will be identified, tracked, and resolved through the CAQ process. Modifications will be handled through the Design Change Notice (DCN) process.

A final report will be issued upon completion of the CAP activities.

8.0 CONCLUSION

This program will assure the structural adequacy and compliance with licensing and design criteria requirements of existing safety-related HVAC duct and duct supports which are required for unit 1 operation. As part of the evaluation, the design criteria will be reviewed and revised as necessary to ensure that they are technically adequate and in compliance with licensing requirements. Technically justified changes to the licensing commitments will be proposed and the FSAR will be revised accordingly. Additionally, design output will be revised or developed to comply with design criteria and to adequately translate design requirements to NC. Any specific attributes that do not meet the design criteria will be modified as necessary. Upon completion of this CAP, WBN safety-related HVAC duct and duct supports will meet licensing requirements and program improvements will be in place to ensure adequacy of new or modified HVAC ducts and duct supports.

9.0 REFERENCES

1. Seismically Qualifying Round and Rectangular Duct, Design Criteria WB-DC-40-31.8.

EXHIBIT A

WBN CORRECTIVE ACTION PROGRAM PLAN - CRITICAL CASE EVALUATION PROGRAM TABLE

	PROGRAM PREPARATION		PHASE I - ENGINEERING OVERVIEW		PHASE III - ENGINEERING EVALUATION (level-I)	(level-II)	(level-III)	PROGRAM CLOSURE
GENERIC CRITICAL CASE EVALUATION PROGRAM	1) Review & revise design reqmt's 2) Establish pre-screen attributes, including CAQ issues. 3) Qualify existing details to revised design requirements	4) Define population 5) Prescreen the population for critical attributes	1) Develop evaluation plans 2) Prepare proced. 3) Training	4) Walkthrough to record critical cases with justification. 5) Review documents to identify critical cases with justification. 6) Walkthrough the selected critical cases which cover all the attributes. 7) Sketch data for the critical cases.	1) Grouping by comparison & categorization 2) Screen the case groups for final critical cases 3) Collect as-built data for the final critical cases with QC concurrence.	1) Final critical cases detailed analysis 2) Final critical cases actual testing	1) Review analysis or test results for acceptables 2) Determine the approach to fix un-resolved cases 3) Implement corrective action	Develop Final Report.
HVAC DUCT AND SUPPORTS CRITICAL CASE EVALUATION	1) YES, Complete design basis CAP Sect. 4.1 2) YES, CAP Sect. 4.1.4 3) YES, CAP Sect. 4.1.2	4) YES, dwg review 5) YES, prescreen from design documents and other tracking systems CAP Sect. 4.1.4	1) YES, CAP Sect. 4.1.4 2) YES 3) YES, CAP Sect. 4.1.4	4) YES, by area, CAP Sect. 4.1.4 5) YES, to supplement 4 above, CAP Sect. 4.1.4 6) NA 7) YES, for critical cases 4 and 5 above, CAP Sect. 4.1.4	1) YES, by types and loading conditions CAP Sect. 4.1.4 2) YES 3) YES	1) YES, CAP Sect. 4.1.4 2) YES, if required CAP Sect. 4.1.4	1) YES, CAP Sect. 4.1.4 2) YES, CAP Sect. 4.1.4 3) YES, CAP Sect. 4.1.4	YES, CAP Sect. 7.0

Attachment 1

BASIS OF CAP

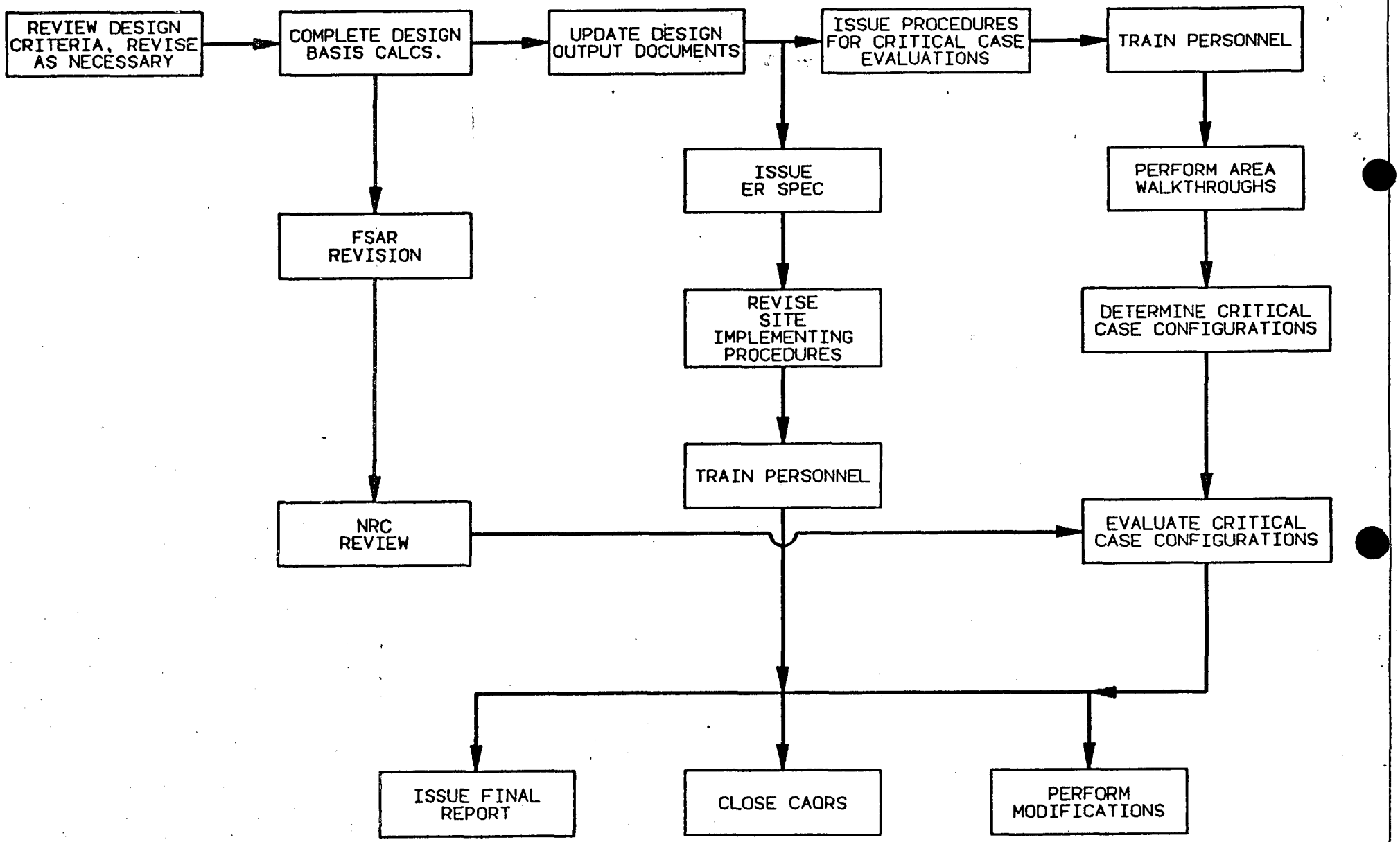
Document Number	Problem Description	Reference
CAQR WBP871029 (50.55[e])	Design Criteria has incomplete requirements in several areas. These include: 1. In-line concentrated weights. 2. Design requirements for welded heavy gage ductwork. 3. Design considerations for transition from flexible to rigid supports. 4. Design requirements for ductwork at cross-sections weakened by cutouts. 5. Design and support of duct-work around direction changes (e.g., bends or branches).	CAQR SQT870843 WBRD-50-390/87-21 WBRD-50-391/87-25
SCR WBNCEB8559 (50.55[e])	Design Criteria lacks adequate justification or documentation in certain areas including dis-crepancies between test data and design criteria requirements.	WBRD-50-390/86-54 WBRD-50-391/86-52
SCR WBNMEB8631	Design Criteria was used in design of heavy-gauge duct. Design Criteria did not cover this type of duct construction.	
PIR WBNCEB8708	Typical pipe/conduit support drawings allow their attachment to duct flanges without con-consideration of duct movement.	
CAQR WBP880038	Duct support typical 47A055-35 static deflection exceeds Design Criteria allowable.	
CAQR WBP870818	Cable trays, piping, and HVAC have not been evaluated for differential movement between buildings.	

Attachment 1

BASIS OF CAP

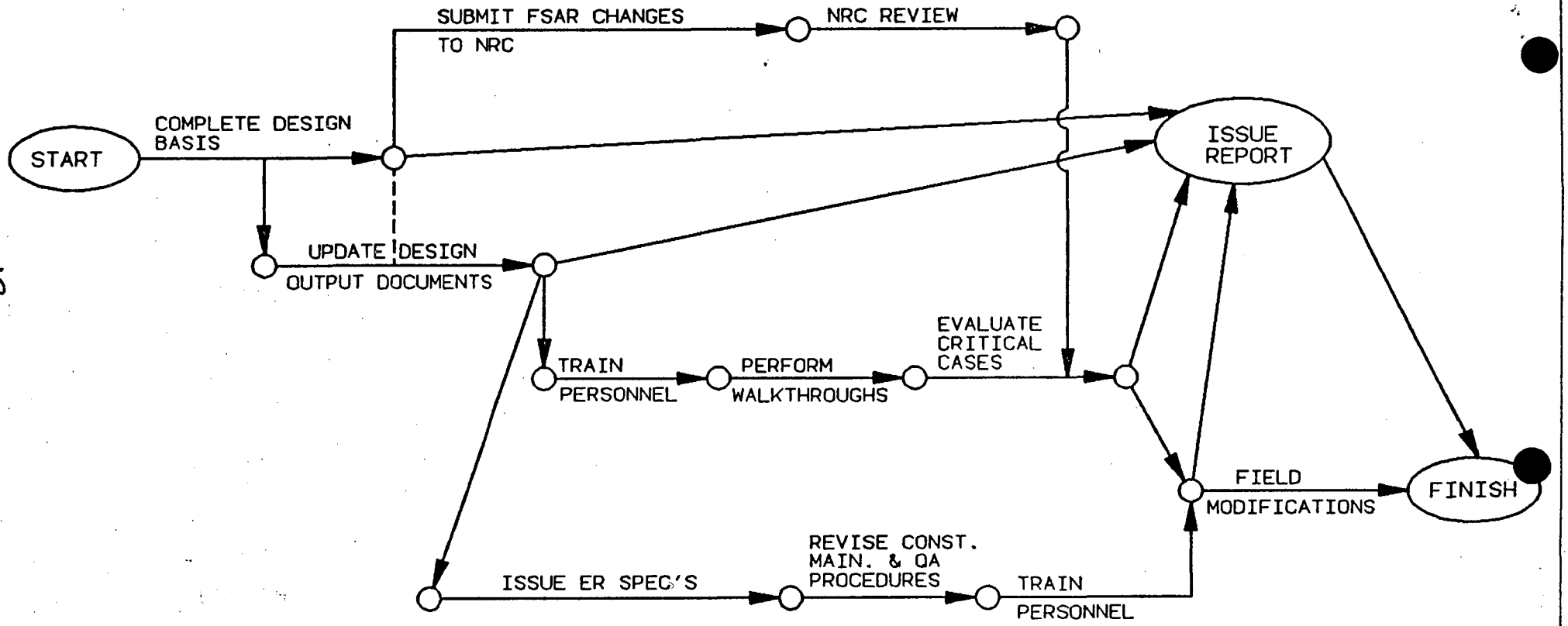
Document Number	Problem Description	Reference
SCR W-580-P-S	Supports not installed per design output requirements.	CATD 11103-WBN-06
NCR 6357	Supports not installed per design output requirements.	EC IN-85-469-002
CAQR WBN870308 CAQR WBN870316	Support not installed per design output requirements.	Violation 390-391/87-07-01
CAQR WBP880104	Contrary to Design Criteria, a typical support drawing supporting round duct does not require a strap loop or ring for a specific support, nor do qualifying calculations provide justification for exception for this support.	WTG DR 999-0043
CAQR WBP880544	Contrary to Design Criteria, some typical supports are not designed to transfer reaction loads primarily by shear into member webs.	VSR DR 004

WATTS BAR NUCLEAR PLANT
HVAC DUCT AND DUCT SUPPORT FLOW CHART



ATTACHMENT 2

WATTS BAR NUCLEAR PLANT
HVAC DUCT AND DUCT SUPPORTS
FRAGNET



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ATTACHMENT 3

W5x2 HVAC DUCT & DUCT SPTS FRAGNET SCHEDULE

ENCLOSURE 2

For the Watts Bar Nuclear Plant, in regard to category I and I(L) HVAC duct and duct supports, TVA commits to:

1. Complete and document the design basis.

2. Update the design output documents consistent with the completed design basis.

3. Revise construction procedures to incorporate design output requirements and train all affected personnel in the use of the revised procedures.

4. Revise maintenance procedures to incorporate design output requirements and train all affected personnel in the use of the revised procedures.

5. Revise quality assurance procedures to incorporate design output requirements and train all affected personnel in the use of the revised procedures.

6. Develop and implement a critical case evaluation of existing installations with corrective actions as appropriate. The number of critical cases to be evaluated will depend on the assessment of walkthrough data.

7. A technically justified Final Safety Analysis Report (FSAR) revision will be submitted to the NRC to update damping values and clarify spectral accelerations.