ENCLOSURE 1

WATTS BAR NUCLEAR PLANT

HANGER AND ANALYSIS UPDATE PROGRAM (HAAUP)

Corrective Action Program Plan

Revision 0

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CORRECTIVE ACTION PROGRAM PLAN

REVISION 0

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HANGER AND ANALYSIS UPDATE PROGRAM (HAAUP)
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HANGER AND ANALYSIS UPDATE PROGRAM (HAAUP)

CORRECTIVE ACTION PROGRAM PLAN

1.0 INTRODUCTION

Throughout the design and construction of the Watts Bar Nuclear Plant (WBN), the Nuclear Regulatory Commission (NRC) has issued various IE Bulletins, Notices, and Circulars on the subject of piping analysis and pipe support design. The May 20, 1985, NRC draft license for WBN (Reference 1) contained five items involving the piping systems and associated pipe supports. The major open item was "The licensee shall complete the reanalysis of safety factors for engineered pipe supports on safety-related systems and associated reanalysis for missing calculations. This reanalysis shall be done in accordance with IE Bulletins 79-02 and 79-14." The draft license specified that reanalysis work "must be completed prior to startup following the first refueling outage."

Additional piping and pipe support issues were identified through several avenues including employee concerns, conditions adverse to quality reports (CAQRs), nonconformance reports (NCRs), problem identification reports (PIRs), significant condition reports (SCRs), and internal and external reviews. The identified issues have been grouped into three categories and are listed below with their root causes:

° Interface Control of Design Input/Output

- Design input was not consistently defined and controlled.
- Design output was not clearly defined and, thus, was not consistently implemented by Construction.

° Design/Analysis Methodology

- Design criteria for piping analysis and pipe support design did not specify a consistent and comprehensive set of design/analysis methods. In some cases, relevant industry issues were not considered.

° Level of Design Documentation

- Requirements for closure of unverified assumptions and documentation of engineering judgments were neither fully defined nor procedurally controlled.

A partial listing of the technical/procedural issues associated with these categories is given in Attachment 1. Additional issues will be resolved through the CAQR process.

2.0 OBJECTIVE

The objective of this Corrective Action Program (CAP) is to assure that piping and pipe support installations are structurally adequate, comply with design criteria, and the design criteria comply with licensing requirements. This objective will be or has been accomplished by completion of the following actions:

- Design criteria and the Final Safety Analysis Report (FSAR) will be revised to ensure consistency and to comply with licensing requirements.
- Procedures will be revised or established to ensure design input/output are controlled and implemented.
- Safety-related piping systems and the associated piping supports will be reevaluated against the revised piping analysis and support design criteria.
- Documentation will comply with design criteria and procedures.

Licensing commitment changes will be proposed only when technically justified.

3.0 SCOPE

The HAAUP scope includes Category I piping, Category I(L) pressure boundary retention piping, Category I(L) position retention piping, instrument lines, and associated supports.

4.0 PROGRAM DESCRIPTION

This section describes the Program Plan, Recurrence Control, and a Licensing Assessment. The general sequence of HAAUP activities for rigorously analyzed ASME piping is shown in Figure 2.1 of Attachment 2. The activities begin with the sources of issues and end with program closure. The related HAAUP documents and documentation system is shown in Table 2.1 of Attachment 2. The elements of the program are described in detail in the following sections.

4.1 Development of Program Plan

Watts Bar Engineering Project (WBEP) established the HAAUP in June 1986 to evaluate the identified issues and develop a comprehensive completion plan to resolve the issues discussed in Section 1.0. A number of these issues resulted from employee concerns and from the lessons learned from Sequoyah Nuclear Plant (SQN) and Browns Ferry Nuclear Plant (BFN) restart programs related to piping/supports. Duke Power Engineering Services, R. L. Cloud and Associates, and the four major WBN contractors (Bechtel [BNAPC], Ebasco [ESI], Sargent & Lundy [S&L], and Stone & Webster Engineering Corporation [SWEC]) participated in or reviewed the development of design criteria and procedures. Known and emerging open items will be resolved as an integrated part of this program.

The updated piping analysis and pipe support design criteria will address the general criteria and the individual requirements of Category I piping, Category I(L) pressure boundary retention piping, Category I(L) position retention piping, instrument lines, and associated supports. The program plan methodology for five piping categories is discussed in the following sections.

4.1.1 Rigorously Analyzed ASME Piping

This part of the scope includes ASME large-bore (greater than 2.0-inch nominal pipe size) piping, ASME Class 1 small-bore (less than or equal to 2.0-inch nominal pipe size) piping, ASME Class 2 and 3 small-bore piping in high-energy systems and associated pipe supports.

As built information for the installed piping and associated pipe supports for this part of scope will be collected through a detailed walkdown (WBEP WP-32). The as-built piping and pipe supports will be reconcilled with the as designed condition using updated design input and design criteria.

4.1.1.1 Interface Control of Design Input/Output

The piping analysis input documents (PAID) procedure WBEP 5.49 defines and establishes the requirements for controlling design input for piping analysis. This procedure identifies the required design input, the definition of responsibilities for providing the input, and the method to be used to transmit the design input to HAAUP. The piping analysis procedure WBEP 5.38 requires the piping analyst to reconcile updated design input with existing calculations.

Methods for controlling design output are defined and established in the piping analysis procedure WBEP 5.38, (for pipe support design data, nozzle load and pipe rupture interface) and the pipe support design procedure WBEP 5.40 (for civil/structural attachments).

The construction specifications were enhanced to clearly define requirements for installing piping and pipe supports.

4.1.1.2 Design/Analysis Methodology

The design criteria for piping analysis and pipe support design define and establish design/analysis methodologies. It should be noted that the original design/analysis was based

on conservative damping values specified in the FSAR. These damping values will be used for analysis unless higher values can be justified. The use of higher damping values will be reflected in the FSAR and design criteria such that the appropriate requirements of the NRC Regulatory Guides 1.61, 1.84, and ASME code case N-411 are satisfied. These higher damping values may be used as the basis for snubber reduction.

4.1.1.3 Level of Design Documentation

Engineering procedures establish requirements for design documentation including documentation of unverified assumptions and engineering judgment.

4.1.2 Alternately Analyzed ASME Piping

This part of the scope includes small-bore ASME process piping not included in Section 4.1.1 and associated pipe supports originally installed and qualified using "cookbook" methodology. Pipe supports were generally "typical" designs rather than individually engineered designs. Three categories of potential deviations on the qualification of piping and supports by these methods have been identified: 1) construction deviations, 2) design features not originally covered in "cookbook" methodology, and 3) changes in technical criteria and design input due to technical issues.

Because of the generic issues identified in the design and construction of this scope of piping and the associated supports, a critical case evaluation will be performed. This evaluation will include the identification of critical piping and pipe support calculations that bound the entire population, CAQRs issued for the piping, and those design/analysis/construction attributes that significantly influence the qualifications of the piping system.

A review of existing documentation for the piping systems and a walkthrough of the population will be factored into this evaluation. The walkthrough will consist of collecting information to identify differences between design and construction documentation, and validation of the identified key attributes. A walkthrough procedure will be developed and walkthrough personnel will be trained in its use.

Those calculations identified from the population as having key attributes, and also those calculations with CAQRs will be identified as potential critical cases. The documentation review and walkthrough will validate the

reasons for the potential critical case determination. As-built information for the critical case calculations will be collected through a detailed walkdown; the walkdown will be similar to WBEP procedure WP-32 requirements .

If appropriate, critical case calculations will be grouped to envelop the most severe conditions. An overview team composed of senior, experienced stress and support engineering personnel will review the selection of the identified critical case calculations.

For each critical case calculation, the piping will be evaluated using rigorous analysis methods in accordance with the piping analysis design criteria. Associated supports included in such critical cases will also be reviewed in accordance with the support design criteria. The critical cases will be considered adequate if the calculation results are within the allowables stated in the applicable design criteria. Those attributes which do not meet the criteria will then be reviewed for the entire population with field modifications implemented as required.

Compliance with IE Bulletin 79-02 will be demonstrated by the critical case analysis.

Table 1 provides more details of the critical case evaluation program plan.

4.1.2.1 Interface Control of Design Input/Output

Interface control of design input/output for critical case evaluations will be the same as for the rigorously analyzed ASME piping.

4.1.2.2 Design/Analysis Methodology

The design criteria for piping analysis and pipe support design for critical case evaluations will be identical to that used for the rigorously analyzed ASME piping.

4.1.2.3 Level of Design Documentation

Engineering procedures establish requirements for design documentation including documentation of unverified assumptions and engineering judgment.

4.1.3 Instrument Lines

Instrument lines (and their associated supports) that cannot be analytically decoupled from the process piping will be included in the appropriate piping analysis (See Sections 4.1.1 and 4.1.2). Instrument lines not covered

by the previous statement will be included in the Instrument Line CAP.

4.1.4 Category I(L) Pressure Boundary Retention Piping

This part of the scope includes non-ASME piping, which must retain its pressure boundary integrity during all plant conditions.

A critical case evaluation of Category I(L) pressure boundary retention piping and associated pipe supports will be performed using the same approach as described for alternately analyzed ASME piping.

4.1.5 Category I(L) Position Retention Piping

This part of the scope includes non-ASME piping that must be supported such that unacceptable interactions with safety-related items do not occur. This piping was installed using dead load span tables provided in ANSI B31.1 and typical pipe support designs. Reference 2 documents the acceptability of the as-installed condition and will be reviewed to assure compliance with updated design criteria.

4.1.6 Pipe Support Component Substitutions

Substitutions of various pipe support standard components with WBN fabrications or modifications have been documented in several CAQRs. A sampling program will be performed using engineering procedures consistent with NCIG-02. The intent of the evaluation will be to verify with 95 percent confidence that at least 95 percent of the population of pipe support standard components will satisfy their specified design basis. WBN materials, dimensions, and fabrication procedures will be reviewed and evaluated.

4.1.7 Pipe Rupture

Analysis of high-energy piping systems will be reviewed to verify the pipe break locations. This review will also include the elimination of arbitrary intermediate breaks where stresses remain below the threshold limit.

Areas of the plant containing safety-related components will be walked down to verify that the previously noted reanalyses and changes since the initial pipe rupture evaluation have not introduced unacceptable pipe rupture interactions. These walkdowns in combination with the initial pipe rupture evaluations will serve to confirm and document the adequacy of the plant from a pipe rupture standpoint.

Calculations for moderate energy lines will also be reviewed to confirm or identify new crack exclusion zones.

4.2 Recurrence Control

Recurrence control measures have been developed to address the three categories of issues discussed in Section 1.0 and consist of the following:

4.2.1 Interface Control of Design Input/Output

- WBEP Procedures define and establish intra- and interdiscipline responsibilities for piping analysis and pipe support design input/output.
- The construction specifications were enhanced to clearly define requirements for installing piping and pipe supports.

4.2.2 Design/Analysis Methodology

- The piping analysis and pipe support design criteria have been enhanced to clearly define design/analysis methodologies.
- Other supporting documents, such as analysis handbooks and the pipe support design manual, will be revised to clarify design requirements and to establish a consistent approach.

4.2.3 Level of Design Documentation

- Engineering procedures for calculations have been revised to require documentation of unverified assumptions and use of engineering judgments.

4.3 Licensing Assessment

In order to resolve the issues identified in this CAP, and to establish an appropriate design basis for HAAUP activities, revisions to the design criteria and FSAR may be necessary. Any changes to the licensing commitments will be proposed only when technically justified.

5.0 PROGRAM INTERFACES

A number of other WBN CAPs interface with the HAAUP, either in a programmatic or production manner. The programmatic interfaces are those in which the methodology specified in one CAP is contingent upon output from another CAP. Production interfaces occur where one CAP impacts the scope of another CAP. Table 2 identifies the interfaces between HAAUP and other WBN CAPs.

6.0 PROGRAM IMPLEMENTATION

Nuclear Engineering (NE) will use the enhanced design criteria and procedures for piping analysis and pipe support design. An Engineering Assurance (EA) audit will be conducted early to ensure effectiveness of procedural enhancements and training. Nuclear Quality Assurance (NQA) and EA will conduct periodic audits of HAAUP activities and deliverables. Nuclear Construction (NC) will implement required modifications. As-built documentation will be reconciled with design output. A fragnet for the HAAUP is given in Attachment 3.

7.0 PROGRAM DOCUMENTATION

Program documentation will demonstrate design criteria and FSAR compliance. Open items such as CAQs will be tracked through TVA's Tracking and Reporting of Open Items (TROI) system. Documents will be entered into TVA's Records and Information Management System (RIMS) or Drawing Management System (DMS). Documents will be controlled through WBN Engineering Records Control Services (ERCS). The following are specific deliverables:

- A report documenting identification and resolution of technical issues.
- Enhanced design criteria and procedures.
- Documentation of critical case selections.
- Walkdown packages for rigorously analyzed piping and associated pipe supports. Critical case evaluation walkdown packages for other scopes.
- Updated calculations for rigorously analyzed piping and associated pipe supports. Critical case evaluation calculations for other piping and associated pipe support scopes.
- Design Change Notices and drawings that have been updated.
- Documented closure of HAAUP open items.

Program closure will be documented in a final report. Completion of deliverables identified above will constitute closure of this CAP.

8.0 CONCLUSIONS

Completion of the Hanger and Analysis Update Program will assure that the subject piping and associated pipe support installations are structurally adequate, meet design criteria reflected in the FSAR, and comply with licensing requirements.

9.0 REFERENCES

1. Letter from T. M. Novak to H. G. Parris, "Draft License and Final Draft Technical Specifications for the Watts Bar Nuclear Plant, Unit 1," dated May 20, 1985.

2. WBN Calculations, "SCRWBNCEB8537 Evaluation Report," Revision 0, August 29, 1986 (B41 860829 913).

TABLE 1 CRITICAL CASE EVALUATION PROGRAM TABLE

	PROGRAM PREPARATION		PHASE I - ENGINEERING OVERVIEW		PHASE II - ENGINEERING EVALUATION (LEVEL - I)	(LEVEL - II)	(LEVEL - III)	PROGRAM CLOSURE
GENERIC CRITICAL CASE EVALUATION PROGRAM	1) Review & Revise design requirements. 2) Establish prescreen 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 procedures 3) Training	4) Walkthrough to record potential critical cases justification. 5) Review documents to identify potential critical cases with justification. 6) Walkthrough the selected potential critical cases which cover all attributes. 7) Sketch data for the potential 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 case 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.
ALTERNATELY ANALYZED PIPING SYSTEMS	1) YES. Revise design criteria WB-DC-40-31.7 and WB-DC-40-31.9. 2) YES. Include CAQRs and also address key attributes. 3) NO	4) YES. Population is alternately analyzed piping systems. 5) YES. An initial group of problems will be analyzed to help identify critical attributes as input to Phase I and II activities	1) Yes. See section 4.1.2 2) Yes. See section 4.1.2 3) YES	4) YES 5) YES. 6) N/A 7) YES. Sketch critical cases.	1) YES 2) YES. 3) YES. Similar to WP-32 requirements	1) YES. Perform rigorous analysis of identified critical case piping problems and associated supports. 2) Dependent on results of above described detailed analysis.	1) YES 2) YES 3) YES	YES, See Section 7.0

TABLE 2 - Interface Between HAAUP and Other WBN Corrective Action Programs

	OTHER WBN PROGRAM	TYPE OF INTERFACE WITH HAAUP	
		PROGRAMMATIC	PRODUCTION
1	Cable Issues		
2	Cable Tray		
3	Electrical Conduit and Conduit Support		
4	Containment Isolation		Input
5	Design Baseline and Verification Program (DBVP)	Input/Output	
6	Electrical Issues		
7	Equipment Seismic Qualification		Input/Output
8	Fire Protection		Input
9	Heat Code Traceability		Input/Output
10	HVAC Duct and Duct Supports	Output	Input/Output
11	Instrument Lines	Output	Input/Output
12	Replacement Items Program (Piece Parts)		
13	Prestart Test Program		
14	QA/QC Records		
15	Q-List		Input
16	Seismic Analysis	Input	Input
17	Vendor Information		Input
18	Welding		Input

Input = HAAUP input is affected by this WBN program.

Output = Output from HAAUP has an effect on this WBN program.

Attachment 1

Basis of CAP

Technical reviews to evaluate the past WBN design criteria and work methods with respect to the licensing requirements, industry practices and deviations identified through several avenues including employee concerns, CAQs, NCRs, PIRs, SCRs, and internal and external reviews, resulted in this partial listing of the following technical/procedural issues:

1. As-Built (walkdown) Data
2. Combination of Response Spectra Analysis Results
3. Effects of Environmental Temperature on Piping
4. Effects of Environmental Temperature on Pipe Supports
5. Effects of Friction on Pipe Supports
6. Effects of Support Mass on Piping Analysis
7. Effects of Support Mass on Support Design
8. Equipment Flexibility
9. Evaluation of Fluid Transients
10. Evaluation of Operating Modes
11. Identification and Documentation of Design Inputs
12. IE Bulletin Number 79-02
13. Integral Welds
14. Localized Pipe Stress Due to Support Components
15. Piping Analysis Model Termination
16. Piping System Functionality
17. Pipe and Pipe Support Welds
18. Pipe Support Component Substitution
19. Rigid Range Effects on Dynamic Analysis
20. Substitution of Piping Components
21. Support Flexibility
22. Surface Plates Welded to Embedded Plates
23. Temperature Cutoff for Piping Analysis
24. Tolerances
25. Uplift on Rod Supports
26. Use of Vendor Load Ratings for Standard Component Supports
27. Variable Damped Spectra Used with Multiple Group Support Motion

The following documents which contain 10 CFR 50.55(e) commitments and NRC inspection and violation items will be reviewed as part of this CAP.

1. NCR W-518P
2. NCRWBN3567
3. NCRWBN5559
4. NCRWBN7192
5. SCRWBNCEB8531
6. SCRWBNCEB8553
7. SCRWBNCEB8570
8. SCRWBNCEB8631
9. SCRWBNCEB8684
10. SCRWBNMEB8616
11. SCRWBNNEB8663
12. Inspection Report SQN 327/86-27, D3.2-4 D3.1-1, D3.2-2, 04.3-8
13. Violation 390/86-22, samples 6, 12, & 25

Attachment 2

HAAUP Activities

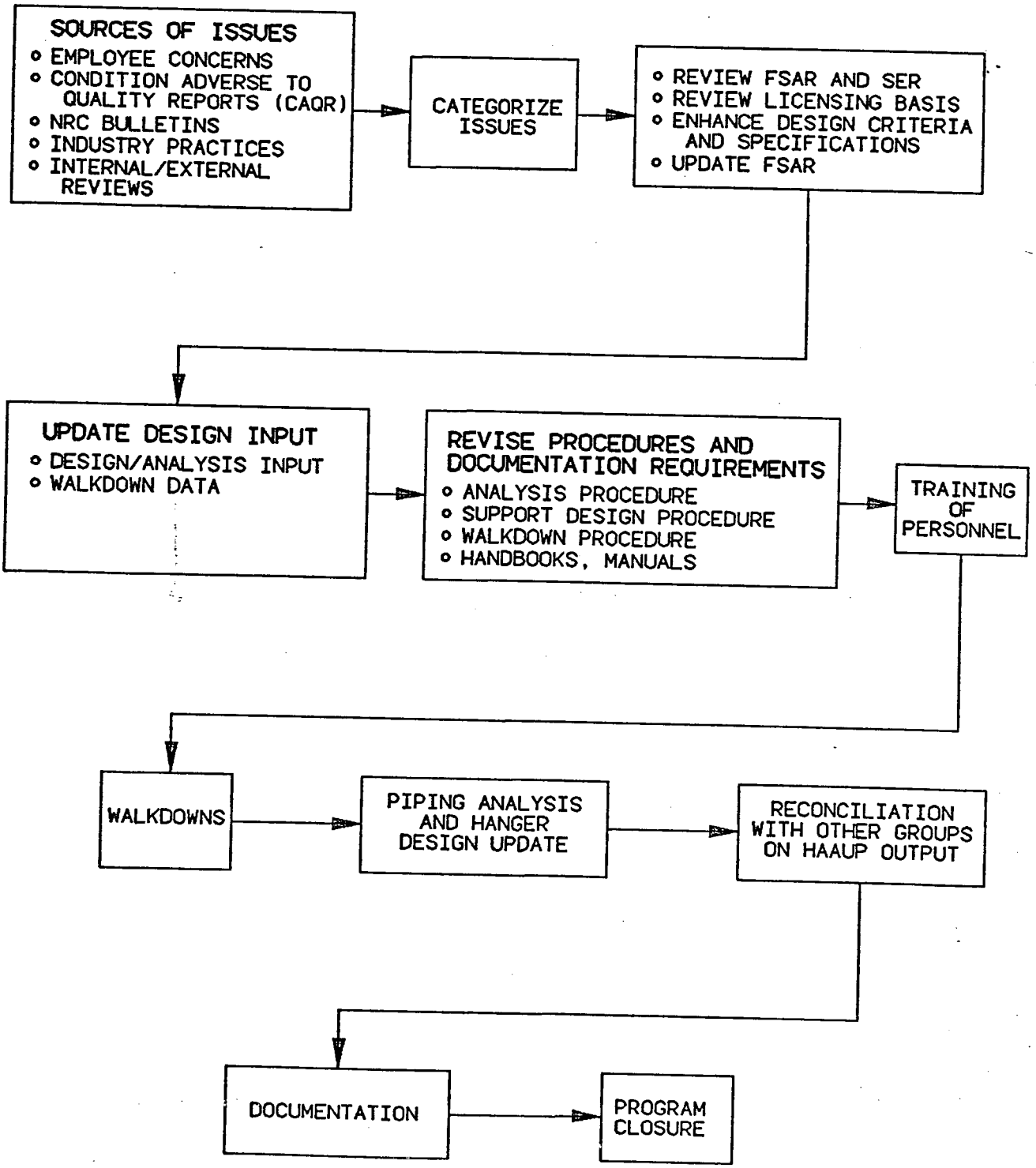
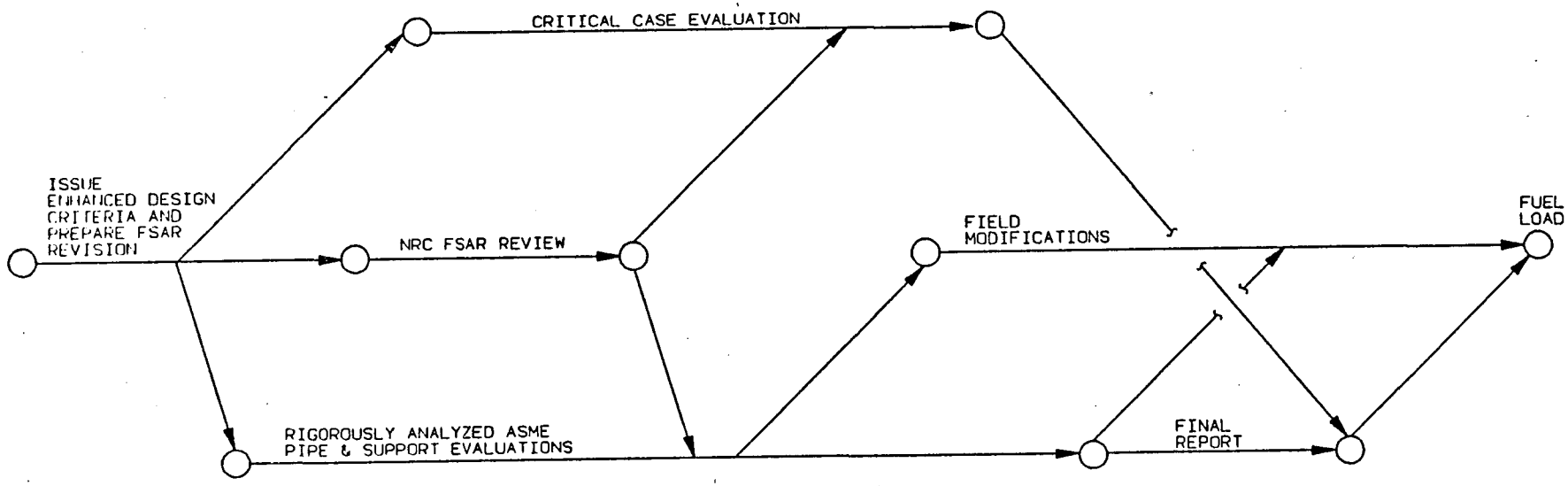


FIGURE 2.1 - FLOWCHART OF HAAUP ACTIVITIES

Table 2.1 - HAAUP Documents and Documentation System

HAAUP Activity	Specific Documents & Documentation Systems
1. Resolve Technical Issues	Report
2. Update Criteria	Piping analysis (WB-DC-40-31.7) and support design (WB-DC-40-31.9)
3. Issue Procedures	Piping Analysis Input Documents (WBEP 5.49), Piping Analysis (WBEP 5.38 and WBEP 5.58), Support Design (WBEP 5.40 and WBEP 5.59), Walkdown (WBEP WP-32)
4. Training of Staff	Training Records
5. Plant Physical Systems Walkdowns	Walkdown Packages
6. Piping and Hanger Design/Analysis Update	Isometrics and Hanger Drawings, Calculations, ASME Class 1 Stress Report
7. Reconciliation with other groups on HAAUP outputs	Design Change Notices (DCN) Quality Information Release (QIR) Calculation Cross Reference Index System (CCRIS)
8. Documentation	Calculations and Stress Reports in Records Information Management System (RIMS), Drawings in Drawing Management System (DMS).
9. Program Closure	Final HAAUP Closure Report

ATTACHMENT 3
HAAUP FRAGNET



ENCLOSURE 2

For the Watts Bar Nuclear Plant, TVA commits to:

1. Design criteria and the FSAR will be revised to ensure consistency and to comply with licensing requirements.

2. Safety-related piping systems and the associated piping supports will be reevaluated against the revised piping analysis and support design criteria.

3. Documentation will comply with design criteria and procedures.

4. Other supporting documents, such as analysis handbooks and the pipe support design manaual, will be revised to clarify design requirements and to establish a consistent approach.