P.O. BOX 5000 - CLEVELAND, OHIO 44101 - TELEPHONE (216) 622-9800 - ILLUMINATING BLDG. — 55 PUBLIC SQUARE

Serving The Best Location in the Nation

MURRAY R. EDELMAN
VICE PRESIDENT
NUCLEAR

January 24, 1985
PY-CEI/NRR-0173L

Mr. Richard C. DeYoung
Director
Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Perry Nuclear Power Plant
Docket Nos. 50-440; 50-441
IDI Inspection 84-29 Response

Dear Mr. DeYoung:

Enclosed is The Cleveland Electric Illuminating Company's response to the results and conclusions of the Integrated Design Inspection of the Perry Nuclear Power Plant. The inspection results are contained in NRC Inspection Report 50-440/84-29, transmitted by your letter of December 12, 1984. The response describes CEI's reviews, evaluations, and corrective actions conducted during and after the inspection. As noted in our response, CEI executive management has closely followed the Integrated Design Inspection and established our response as the top priority in the current PNPP design effort. The format of our response is as follows:

- Section 1.0 is an overview of our response effort and conclusions.
- Section 2.0 is a summary of our responses to the major technical and programmatic conclusions identified in the IDI Report.
- Section 3.0 is an item-by-item response to each Deficiency, Unresolved Item, and Observation contained in the IDI Report. Each response includes a brief summary of the principal issue(s) raised in the item, the results to date of our evaluations, and any corrective actions taken.

As noted in our response, upon receipt of the inspection report, CEI established a Task Force of our key engineering management, including Gilbert/Commonwealth and General Electric management, to review the findings, develop responses, and define necessary corrective actions. The Task Force had an overview team, which had the responsibility of addressing the cumulative effects of the findings. The overview considered all of the issues raised in the five technical discipline areas and the four programmatic areas. The conclusions reached by our Task Force support those reached as a result of your inspection, that the adequacy and effectiveness of the PNPP design control program has been confirmed. Thus, as we complete Perry Unit 1 this year, we have a plant design that meets or exceeds requirements.

Our staff is available to work with you on a timely closeout of this inspection.

Very truly yours,

Murray R. Edelman

Murray R. Edelman
Vice President
Nuclear Group

MRE:bmr

Enclosure

cc: Jay Silberg, Esq.
John Stefano
J. Grobe
D. Keating

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

A - Ampere

AC - Alternating Current

ACI - American Concrete Institute

AISC - American Institute of Steel Construction

ANS - American Nuclear Society

ANSI - American National Standards Institute

ASME - American Society of Mechanical Engineers

ATWS - Anticipated Transient Without Scram

AWG - American Wire Gauge

BOP - Balance of Plant

BTP - Branch Technical Position

BTU - British Thermal Unit

CEI - Cleveland Electric Illuminating Company

CFR - Code of Federal Regulations

CIC - Calculation Index Code

DBE - Design Basis Event

DC - Direct Current

DGB - Diesel Generator Building

DI - Design Input

ECCS - Emergency Core Cooling System

ECN - Engineering Change Notice

EQ - Equipment Qualification

EQRL - Equipment Qualification Review List

ERIS - Emergency Response Information System

ESW - Emergency Service Water

ESWPH- Emergency Service Water Pumphouse

E-W - East - West

EWD - Elementary Wiring Diagram

F - Force

°F - Degree Farenheit

FHB - Fuel Handling Building

FSAR - Final Safety Analysis Report

ft. - Feet

$ft.^2$ - Square Feet

G/C - Gilbert/Commonwealth, Incorporated

GE - General Electric Company

HPCS - High Pressure Core Spray

hr. - Hour

HVAC - Heating, Ventilating and Air Conditioning

Hz - Hertz

I&C - Instrumentation and Control

IDI - Integrated Design Inspection

IE - Inspection and Enforcement Branch

IEEE - Institute of Electrical and Electronic Engineers

INPO - Institute of Nuclear Power Operations

IPCEA- Insulated Power Cable Engineers Association

ksi - Kips per Square Inch

kV - Kilovolt

LOCA - Loss of Coolant Accident

LOOP - Loss of Off-Site Power

LPCS - Low Pressure Core Spray

MDSL - Manufactures Documentation Submittal List

NFPA - National Fire Protection Association

NPSH - Net Positive Suction Head

NRC - Nuclear Regulatory Commission

N-S - North - South

NSSS - Nuclear Steam Supply System

OBE - Operating Basis Earthquake

P&ID - Piping & Instrumentation Diagram

PE - Project Engineer

PGCC - Power Generation Control Complex

PNPP - Perry Nuclear Power Plant

PSAR - Preliminary Safety Analysis Report

psi - Pounds per Square Inch

RAI - Request for Additional Information

RCIM - Raceway and Cable Installation Modification

Rev. - Revision

RG - Regulatory Guide

RHR - Residual Heat Removal

RPV - Reactor Pressure Vessel

S - Stress

SERT - System Engineering Response Team

SQRT - Seismic Qualification Review Team

SRP - Standard Review Plan

SSE - Safe Shutdown Earthquake

Std. - Standard

V - Volt

1.0 OVERVIEW

This report responds to the results and conclusions of the Integrated Design Inspection of the Perry Nuclear Power Plant (PNPP) conducted by the NRC's Office of Inspection and Enforcement. The inspection results are contained in NRC Inspection Report 50-440/84-29 (IDI Report), transmitted to The Cleveland Electric Illuminating Company (CEI) on December 12, 1984. The inspection covered the five technical discipline areas of the design: mechanical systems, mechanical components (piping), civil/structural, electrical power, and instrumentation and control (I&C). This report describes CEI's reviews, evaluations, and other actions in response to the Integrated Design Inspection.

1.1 CEI TASK FORCE RESPONSE

CEI's executive management has established the NRC's Integrated Design Inspection as the top priority in the current PNPP design effort. Our response commenced as preliminary NRC findings and conclusions were communicated during the course of the inspection, even before the formal published findings were received. Immediately following the NRC exit meeting held on October 12, 1984, CEI established a Task Force to review and initiate appropriate action to respond to the IDI findings. CEI executive management, which closely followed the NRC's inspection, directed that the Task Force include senior engineering personnel responsible for the design of the plant.

The CEI-directed Task Force included key design management personnel from CEI; Gilbert/Commonwealth, Inc. (G/C), the architect/engineer; General Electric Company (GE), the Nuclear Steam Supply System designer; and additional support staff. There were 20 management and supervisory engineering personnel dedicated to the Task Force. These 20 individuals have a total of over 250 years of experience in nuclear engineering and related fields. This group was supported by discipline engineers in the CEI, G/C, and GE offices. To date, the Task Force, including support personnel, has spent over 25,000 hours in performing reviews, evaluations, and other actions in response to the IDI findings.

The Task Force effort included item-by-item reviews and evaluations of the findings in the IDI Report by a response team comprised of G/C and GE personnel under the direction of CEI. For each item where appropriate, the response team evaluated the extent of the condition, cause, impact on overall design, corrective actions, and action to prevent recurrence, where appropriate.

The Task Force also included an overview team, which had the responsibility of addressing the cumulative effects of the findings. The overview team reviewed and evaluated the results of these item-by-item responses. The overview team considered all of the issues raised in the five technical discipline areas, and in each case looked beyond the individual finding to address potential implications of the finding on the design control program. Our overview gave special emphasis to the five significant technical issues and four programmatic concerns listed in the "overall conclusions" set forth in Section 1.5.6 of the IDI Report. Our overview team reviewed the individual IDI responses and participated in the conclusions reached in this response.

1.2 IDI AND TASK FORCE CONCLUSIONS

As with any inspection report, the primary thrust of the IDI Report was to identify potential problem areas. Still, the IDI Report was careful to point out that "[i]n our evaluation we found many design actions that were being well executed." (IDI Report, Section 1.2). The IDI Report emphasizes this same positive perspective in Section 1.5.6, which states:

> The report and its summaries have highlighted only the problem areas identified during the inspection. To present a properly balanced picture it should be understood that the identified deficiencies were based on review of thousands of pages of technical documentation by an experienced inspection team. Many positive elements were identified including high energy line break documentation; accuracy in transfer of civil/structural design information from calculations to drawings; and effective design control in instrument procurement specifications, instrument data sheets, and the environmental qualification program. Two significant positive aspects are Cleveland Electric's ongoing review of the FSAR to identify its inconsistencies with the design, and initiative in independently assessing the problems identified by the team during the inspection in order to promptly take corrective actions.

In the course of its review and evaluation of the IDI Report, the Task Force has performed comprehensive recalculations and design reviews in each of the five technical discipline areas covered by the Integrated Design Inspection. The results of these reviews confirm what we have found throughout the PNPP design process in reviews performed by CEI, G/C, GE, and the NRC: the overall PNPP design and design control program are sound, and meet or exceed applicable requirements. Our findings support the conclusion stated at page 3 of Mr. DeYoung's December 12, 1984 letter, and in Section 1.5.6 of the IDI Report, that

> [n]one of the identified deficiencies, either collectively or individually, are such that the overall adequacy of the Perry plant design is called into question, pending satisfactory resolution of the items identified in the inspection report.

1.3 DOCUMENTATION FINDINGS

Many of the findings from the Integrated Design Inspection concern the documentation of the PNPP design, rather than the design itself. It is important to put the IDI documentation findings into proper perspective. The principal standards governing design documentation are established in ANSI N45.2.11. ANSI N45.2.11 contains general requirements, and places significant discretion with the design originator and verifier as to the level of detail required in the design documentation. Because of the amount of individual judgement required to apply ANSI N45.2.11, it is not surprising that members of the IDI team in some cases concluded that additional documentation should have been provided. Where IDI team members had a different judgement concerning the level of documentation required to meet ANSI N45.2.11, in most cases we have performed supplemental evaluations and have provided additional detail in documentation.

The Task Force has reviewed every area of the documentation analyzed in the IDI Report, as well as documentation in addition to that reviewed by the IDI team. The Task Force, which has many years of nuclear design experience, has reviewed thousands of pages of design documentation to address the IDI findings. These reviews confirm that the overall approach to design documentation has been sound. Notwithstanding the different judgements on the level of documentation called for by the ANSI standard, as evidenced by IDI findings, we believe the Integrated Design Inspection and the Task Force reviews provide an important additional level of confidence in the PNPP design.

2.0 TECHNICAL AND PROGRAMMATIC SUMMARIES

Section 1.5 of the IDI Report describes the "major conclusions" of the Independent Design Inspection for each of the five technical areas of the plant design. Section 1.5.6 highlights the IDI Report's "overall conclusions," which cover five technical issues and four less significant programmatic issues. Our responses to these issues are summarized below. Additional detail is supplied in the item-by-item responses in Section 3 of this report.

2.1 MECHANICAL SYSTEMS

The Task Force findings and actions taken in response to the IDI Report's "major conclusions" in the mechanical systems area (IDI Report, Sections 1.5.1 and 1.5.6) are as follows:

- o Room Cooler Sizing

The Task Force evaluated the original Residual Heat Removal (RHR) and High Pressure Core Spray (HPCS) room cooler sizing calculations, and also evaluated the later temperature profile calculations used for equipment qualification in these rooms. These evaluations demonstrate that the original calculations were adequate to purchase the rocm coolers. The Task Force also performed additional calculations which confirm that the RHR and HPCS room coolers are adequately sized, and that equipment within the rooms meets qualification requirements. The additional calculations resulted in lower temperature values, and demonstrate that the original temperature profiles were conservative. In addition, calculations are being performed for the remaining areas in the Auxiliary Building. The results to date for Auxiliary Building areas outside the RHR and HPCS rooms also demonstrate the adequacy of the original design.

o Emergency Service Water (ESW) Cooling Water Inlet Temperature

The Task Force performed new calculations documenting the value of the maximum cooling water temperature. The review of these calculations shows that the recalculated system temperature has no impact on systems served by the ESW system.

o Pipe Break and Jet Displacement Study

The Task Force is verifying the study and addressing all IDI concerns to assure that design work in this area is adequate and controlled. Based on the results to date of this analysis, no design changes are anticipated.

o Documentation Supporting Design

The Task Force performed extensive reviews and in many instances, additional calculations in response to the IDI mechanical discipline items. These reviews are described in detail in the item-by-item responses set forth below. The conclusion from this effort is that the findings do not call into question the overall adequacy of documentation supporting the mechanical system design.

o Overall Design Approach

The IDI Report emphasizes that a "very conservative design approach" was evident in the mechanical systems area. The Task Force findings, summarized in detail in Section 3, confirm the conservatism in the original design approach.

2.2 MECHANICAL COMPONENTS

The Task Force findings and actions taken in response to the IDI Report's "major conclusions" in the mechanical components area (IDI Report, Sections 1.5.2 and 1.5.6) are as follows:

o Pipe Stress Analysis for the Faulted Condition

The Task Force performed an evaluation of the effects of thermal nozzle loads in the faulted condition on Nuclear Steam Supply System

(NSSS) equipment. The results of the evaluation to date indicate that inclusion of piping thermal stresses on nozzle loadings on NSSS equipment does not affect the original design.

- Dynamic Modeling

The Task Force is expanding earlier evaluations of non-rigid equipment to include GE and HVAC equipment. In light of the conclusions reached prior to the Independent Design Inspection with respect to other types of equipment, we do not anticipate any design changes to piping systems attached to the GE and HVAC equipment.

- ESW Piping Thermal Gradient and RHR Heat Exchanger Thermal Loads for the Upset Condition

The Task Force performed additional analyses specifically incorporating these thermal loading conditions. The analyses to date confirm that the resulting loads are adequately covered by the existing design.

- Safety Relief Valve (SRV) Discharge Line Ball Joint Analysis

The Task Force performed additional analyses to address the specific IDI concerns identified. The analyses show that the resulting loads are within the allowable limits of the original design.

- Pipe Support Designs and Analysis

The Task Force performed a detailed review of each item involving pipe support design and analysis. In all cases the original design was found to be adequate.

2.3 CIVIL/STRUCTURAL

The Task Force findings and actions taken in response to the IDI Report's "major conclusions" in the civil/structural area (IDI Report, Section 1.5.3) are as follows:

- ESW Pumphouse Structural Reanalysis of Exterior Walls

The Task Force reviewed the ESW Pumphouse exterior wall analysis performed prior to the Independent Design Inspection, in light of various IDI concerns with the analysis. The review included a finite element analysis of the ESW Pumphouse walls. The Task Force concluded that the Pumphouse walls were adequately designed.

- Seismic Analyses

The Task Force reviewed each of the seismic issues raised in the IDI Report, and conducted additional analyses, including updating of models and additional calculations. The Task Force results to date indicate that the original seismic analyses and resulting plant designs are adequate.

- Civil/Structural ACI Code Applications

The Task Force evaluated the use of ACI Codes in deep beam design and shear bar spacing. As explained in the detailed responses in Section 3 below, for those few instances in which Code criteria were exceeded, the overall design was still conservative and no changes were necessary.

2.4 ELECTRICAL POWER

The Task Force reviews and actions taken in response to the IDI Report's "major conclusions" in the electrical area (IDI Report, Sections 1.5.4 and 1.5.6) are as follows:

- Voltage Drop

The Task Force is continuing the reviews, begun prior to the IDI, of the effects of voltage drops on AC and DC circuits during starting and operating conditions. To date, the Task Force has identified only a few cases of excessive voltage drop, which are being further evaluated.

- Protective Relaying and Fuse Sizing

The Task Force is reviewing all Class 1E protective relay settings to assure that concerns identified by the IDI Report are fully evaluated. Some setting changes are being made to maintain a consistent design approach, but are not considered significant to plant safety functions. In addition, the Task Force has found that the original selection of fuse sizes for valve motors had an appropriate technical basis.

- Electrical Separation

The Task Force reviewed the separation issues raised in the IDI Report. Although there were some documentation discrepancies, the final design issued for construction meets regulatory requirements.

2.5 INSTRUMENTATION AND CONTROL

The Task Force findings and actions taken in response to the IDI Report's major conclusions in the instrumentation and control area (IDI Report, Section 1.5.5) are as follows:

- Random Design Errors

The Task Force evaluated the two "random design errors" in the loss of off-site power (LOOP) signal design and the main steam leak detection system design summarized in Section 1.5.5 of the IDI Report. The LOOP signal has been modified, and the evaluation of the main steam leak detection system indicates that the installation meets design requirements.

o Setpoint Calculations

The Task Force evaluated the IDI team's concerns with the sufficiency of documentation to support instrument setpoint values. The Task Force reviewed the basis for including safety-related setpoints on the setpoint list and the source document package. This review has confirmed that adequate bases are available to support setpoint values.

o Documentation Inconsistencies

The IDI Report cited inconsistencies and apparent errors which, according to the IDI Report, "did not indicate any systematic pattern." The Task Force reviewed and resolved each of these items, as discussed in the item-by-item responses below. Review and analysis of these items have reinforced our confidence that the design and the design control process are adequate.

2.6 IDI PROGRAMMATIC ISSUES

o FSAR Discrepancies

Section 1.5.6 of the IDI Report states that there were "some instances" identified in which FSAR commitments were not met or were contrary to the plant design or design documentation. The Task Force reviewed all cases cited in the IDI Report, and has confirmed that the discrepancies are minor. The discrepancies found do not call into question the adequacy of the design or design control program. A number of the discrepancies identified in the IDI Report were identified prior to the Integrated Design Inspection. Given the iterative nature of the design process for a nuclear power plant, at any given point in time there are FSAR provisions and related documentation which require review and updating. Prior to the IDI, CEI had implemented an FSAR verification program to assure that FSAR discrepancies are identified and corrected. The IDI Report at page 1-8 acknowledges that CEI's "ongoing review of the FSAR to identify its inconsistencies with the design" is among the "significant positive aspects" of CEI's design program.

o Design Traceability

Our comments in Section 1.3 above apply to the issue of design traceability under ANSI N45.2.11. As noted above, ANSI N45.2.11 provides general requirements, and places significant discretion with the design originator and verifier regarding the level of documentation necessary to support the design. The G/C and GE design teams, each of which had significant qualifications and prior nuclear experience, in some cases made judgments that were different than judgments made by the IDI team regarding the types of assumptions and decisions which must be documented as part of the formal design. Rather than debate these judgments, in most cases the Task Force has supplemented the design documentation in response to the IDI Report. As previously noted, supplemental analyses of the Task Force confirm the overall adequacy of the original design approach.

o Design Verification

Design verification requirements are contained in general terms set forth in ANSI N45.2.11. The extent and depth of verification permitted by ANSI N45.2.11 can vary from spot checking to detailed analysis, and depends on considerations such as "the complexity of the design, the degree of standardization, the state-of-the-art, and the similarity with previously proven designs." (ANSI N45.2.11 [1974], Section 6.2). Again, ANSI leaves significant discretion with the verifier. Since ANSI does not require line-by-line checks of all details in the design package, it is expected that minor calculational differences might go undetected. However, the extent and depth of the design verification is established at a level to detect significant differences which would affect the adequacy of the design. The Task Force confirmed that there was no pattern of omissions or mistakes by PNPP design verifiers, and that the verification process and the plant design are adequate.

3.0 ITEM-BY-ITEM RESPONSES

This section provides responses to each of the Deficiencies, Unresolved Items, and Observations contained in the IDI Report. For each item, there is a brief summary of the principal issue(s) raised by the item. Each response describes the evaluations, analyses, and other applicable actions which have been performed to date by the Task Force. Where our responsive actions are not complete, a current completion schedule is indicated.

3.1 MECHANICAL SYSTEMS

Set forth below are our item-by-item responses to the Mechanical Systems Deficiencies, Unresolved Items, and Observations identified in the IDI Report. The number and title of each item are taken directly from the IDI Report.

D2.1-1 (Deficiency) Inadequate Consideration of Factors Affecting Emergency Service Water Inlet Temperature

Summary of Item

This item describes documentation deficiencies relating to (1) design data used to establish the basis for selecting 80°F as the maximum inlet temperature for the design of the Emergency Service Water System, and (2) design assumptions about the effect of using the discharge tunnel as a backup source of cooling water to the Emergency Service Water System.

Response

The design basis for (1) above was supported by a lake temperature survey (NUS Letter PY/NUS-CEI-260), which was not referenced in the formal design criteria. In response to this item, Calculation P45-25 has been made. The calculation confirms the adequacy of the original design value of 80°F.

The undocumented assumption used in the design, summarized in (2) above, was based on an engineering decision that the use of the heated water from the discharge tunnel would have a minimal impact on the performance of the Emergency Service Water System. The decision was based on a consideration of factors such as the seismic design of the intake tunnel, the low probability of a total intake tunnel collapse combined with total blockage of incoming lake water, and the limited duration of any heated water effects. In response to this item, Calculations P45-24 and P45-31 were performed. These calculations confirm the appropriateness of the original design assumption that the effect of using the discharge tunnel as a backup source of cooling water would have no significant impact on components cooled by plant cooling water systems.

The additional calculations performed in response to these items demonstrate that there is no adverse impact from the use of the undocumented design data and design assumption discussed above.

D2.1-2 (Deficiency) Inadequate Substantiation of Seismic Restraint for Chlorination Piping in Emergency Service Water Pump Forebay

Summary of Item

This item addresses the potential interaction during a seismic event of nonsafety-related chlorination piping and safety-related Emergency Service Water pumps located in the Emergency Service Water pump forebay. The item indicates that no interaction analysis was documented, and questions whether the chlorination piping could be drawn into the pump suction during a seismic event.

Response

No specific safety-nonsafety interaction analysis was performed. The Emergency Service Water pumps are the only safety-related pumps at Perry with open suctions. All other pumps have closed suctions and are, therefore, not susceptible to the potential interaction discussed in this item. The failure to perform an interaction analysis in this instance is probably explained by the unique location and configuration of the system, and the difficulty of recognizing the need for an interaction analysis in this case.

To address this item, G/C evaluated the chlorination piping servicing the Emergency Service Water pumps. This evaluation, documented in Calculation P326, demonstrates that the original support configuration is adequate to prevent failure of the pipe during a seismic event and to prevent any potential obstruction of the pumps. Consequently, the operation of the Emergency Service Water System during a seismic event is not affected, and no hardware modifications are required.

Because of the unique circumstances of this configuration, it is not believed that the ongoing programs for evaluating potential spatial interaction of nonsafety-related on safety-related systems and components are affected. In light of the analysis performed in response to this item, no further action is deemed necessary.

D2.1-3 (Deficiency) Failure to Document Substantiation for Emergency Service Water Pump Vacuum Breaker Check Valve Size

Summary of Item

This item states that specific analyses were not performed to assure that the size of the Emergency Service Water pump discharge vacuum breaker check valves, and the pump start-up sequence subsequent to a pump trip, would not result in water hammer loads on the Emergency Service Water piping.

Response

No specific water hammer analysis was deemed necessary for this system. The design input included the considerations for all critical operating characteristics of the system in accordance with ANSI N45.2.11. The engineering decision that water hammer was not a critical characteristic was based on the design of the system, including the relative sizes of the pump and vacuum breaker check valve, the addition of an in-line check valve to minimize system drainage, the speed of the pump, the minimal amount of air flow needed to drain the applicable portion of the piping system, the amount of time available in which to drain the pump and restart the pump, and the demonstrated ability of similar systems at other operating plants to preclude water hammer. We do not believe that ANSI N45.2.11 required a calculation to confirm the type of engineering decision covered by this item.

Nonetheless, in response to this item, the Perry Preoperational Test Program (TS P45, Addendum E) has been modified to require observation of the system performance with regard to water hammer during pump restart and operation. This modified test program provides additional assurance that the system design precludes the occurrence of water hammer. Because the original engineering decision is still considered appropriate, no design or hardware modifications are required.

Other systems (e.g., Feedwater, Residual Heat Removal, Control Rod Drive, Main Steam) have been designed, and calculations have been performed as required, to account for potential water hammer effects. Accordingly, this item does not raise a "systematic" issue.

For these reasons, no other action is deemed necessary to address this item.

D2.1-4 (Deficiency) Inadequate Documentation to Support Overpressurization Protective Devices

Summary of Item

This item states that specific calculations were not performed to assure that the Emergency Service Water thermal relief valves were adequately sized to protect the system piping and components.

Response

No analyses of the type discussed in this item were deemed necessary. The selection of the Emergency Service Water thermal relief valves was based on the rate of heat input to the component, and G/C's prior experience with similar applications at other plants. The selection was also supported by the fact that the release of a very small amount of water from an enclosed volume results in rapid pressure relief, because water is an incompressible fluid. In light of these factors, it was determined that the selection of the relief valves was not a critical consideration in the design requiring documentation under ANSI N45.2.11. It is our understanding that this approach to selecting thermal relief valves was consistent with standard industry practice.

Nonetheless, to respond to this item, Calculations P45-28 and P42-12 were performed. These calculations demonstrate the validity of the original design decision concerning thermal relief valve capacity requirements under worst case conditions in the Emergency Service Water and Emergency Closed Cooling Water Systems.

The calculations performed in response to this item demonstrate the adequacy of the methodology of selecting thermal relief valves for other cooling systems.

In light of the above, there are no further analyses and no hardware modifications required to address this item.

D2.1-5 (Deficiency) Inadequate Documentation to Support Hydraulic Analysis for Emergency Service Water System Design

Summary of Item

This item raises a concern with the degree of clarity and consistency in the design documentation package for the Emergency Service Water System hydraulic analysis. The IDI Report concludes that there were deficiencies in some of the calculations in the documentation package, including undocumented vendor input, unsubstantiated input from interfacing disciplines, unverified assumptions, inconsistencies, or nonconservative methods of analysis.

Response

We have performed a detailed review of the original package for the Emergency Service Water System hydraulic analysis with respect to the concerns identified in this item. The results of that review are summarized in the item-by-item discussion set forth below. In addition, in response to this item, G/C has performed and documented a detailed reanalysis (Calculations 2.6.4.1, 2.6.4.1.1, 2.6.13.1, and 2.6.13.1.1) of the hydraulic design of the Emergency Service Water System. This reanalysis confirms that, although portions of the original documentation package were difficult to follow, its conclusions are valid and the present design has adequate margin utilizing the installed (smaller) impeller. To further clarify the documentation package, the Emergency Closed Cooling Water System was reanalyzed (Calculation 2.6.3.1). This calculation and the other calculations identified in this paragraph confirmed the adequacy of the margin in the original design.

An item-by-item discussion of the documentation issues raised in this IDI item is set forth below.

1. Calculation 2.6.4, Revision 1

   a. The IDI Report states that there is no assurance that Revision 0 and Revision 1 reflect consideration of all system operating modes, especially discharge to the swale upon blockage of the tunnel.

      The original calculation was intended to evaluate whether the system would function using excess capacity in the throttling valves. It was not considered necessary to define precise operating values because the system is manually balanced during start-up and testing. Accordingly, the results memorandum of the calculation stated:

      > The PIPF [computer code] output indicates that with the proper valve settings, the flow rates desired can be reached and maintained during plant operation.

Because of the available system margin determined at that time, it was not considered necessary to evaluate all possible permutations of the system operation, including discharge to the swale.

In light of the above, the operating mode of discharge to the swale was not considered a critical design characteristic requiring documentation under ANSI N45.2.11. As required by ANSI N45.2.11, this decision can be verified without recourse to the originator.

The new analysis takes into account the items raised in the IDI Report. The analysis shows a minimum available excess capacity in the system of 40 psi and 43.5 psi, respectively, for the cases of discharge to the tunnel and discharge to the swale. The original analysis indicated a minimum available excess capacity of approximately 35 psi in the system, which constitutes less design margin than is shown in the current analysis. The reanalysis substantiates the originator's documented decision made in the original analysis (Calculation 2.6.4, Revision 0) that errors in the original computer model would not change the overall conclusions.

In addition, this item states that no "linkage was provided between the computer runs and the calculation." It is agreed that the calculation cover pages did not specifically itemize the computer runs by job number. However, the computer runs were microfilmed with the cover pages as part of the permanent project record. The entire file is available as an integral package.

b. This item questions whether all modes of operation require the same throttling (pressure drops). The specific values were in error on the computer runs. The fact that errors existed was documented by the originator (Calculation 2.6.4, Revision 0); and it was concluded by him, the system engineer, and the verifier that the errors were minor and were not material to the overall system performance. Moreover, as noted in the response to item (a) above, it was not necessary to define precise operating values in the analysis.

The revised calculation confirms that all modes of operation can be maintained without adjusting the throttling valves.

2. Calculation 2.6.4, Revision 0

a. The IDI Report questions whether the engineer met the objective of Calculation 2.6.4, Revision 0. The objective of the calculation was to confirm the ability of the Emergency Service Water System to provide adequate flow to all system components during various modes of operation. This objective was met, as documented in the memorandum transmitting the results of the analysis to the system engineer, which stated that "with the proper valve settings, the flow rates desired can be reached and maintained ...."

The item states that no evaluation of the flows obtained was presented in the analysis. No evaluation of the flows was required in the analysis because the information constituted input values and not results.

In addition, the item states that the significance of the additional pressure drops at each throttle valve relative to any flow margin was not evaluated. The computer analysis resulted in positive pressure drops at every throttle valve. These positive pressure drops indicated to the originator and the system engineer that the Emergency Service Water pumps had excess head and would provide adequate flow to all components. Since the purpose of the calculation was to determine whether adequate flow could be provided, and was not to evaluate the margin at each component, individual evaluations of each pressure drop were not necessary to meet the objective of the calculation.

b. This item notes that the minimum water level was not used in consideration of the static head, that there was no provision for column friction losses, and that there was no documented reference of the basis for modeling the pumps in the calculation. The original calculation was based on mean lake level which is 5-feet higher than low lake level. The mean lake pump head is 2-1/2 psi greater than the head at low lake level, which is negligible compared to the available margin. In addition, the original calculation did describe in detail the technique for modeling the pumps and included a discussion of the influence of static head and column friction losses. The reference omission, no written documentation from the vendor supporting the interpretation of the pump performance curve, has been corrected by the updated calculation, performed in response to this item. The updated calculation does include as design input a documented hard-copy reference for the pump curve development basis. As indicated in the response to item 1(a) above, the updated calculation confirms the adequacy of the original design.

c. This item identifies the use of certain unnumbered pages in the design package. The pages referenced in this item were worksheets of the originator. The worksheets were included for convenience; they were not part of the formal design, and were not required for origination or review of the package.

d. This item notes that the temperatures used in the analysis differ from those given on the P&IDs. The difference is explained by the fact that the original hydraulic analysis pre-dates the development of the temperature data. In any case, the hydraulic analysis is relatively insensitive to the precise values within the temperature range of interest. Therefore, use of detailed values was not considered necessary since the results would not be affected. The issue regarding the calculations to substantiate the temperatures is addressed in the response to item D2.1-8.

e. This item identifies several cases in which design documents were not modified to respond to comments by the reviewer. As indicated below, in the three cases cited in this item there was no necessity to modify the design documents. The item also suggests that there was no specific written resolution of comments by the verifiers. Design Control Procedure 3.6.1, Revision 1, in effect at the time of the calculation, did not require written resolution of verifiers' comments. Satisfactory resolution of the verifiers' comments was sufficiently documented by the verifiers' attestation signatures on the calculation cover sheets.

This item raises specific questions about sheets 25, 21, and 68 of the calculation. With respect to sheet 25, documentation does exist for this sheet; but the documentation is not required as part of the official package. The documentation details the resolution of the verifier's concern and substantiates the originator's values. With respect to sheet 21, the extra 100 feet of pipe shown on the sheet was acknowledged by the originator and incorporated into the Revision 1 analysis. In accordance with the decision made on the Revision 0 analysis, discussed in the response to item 1(a) above, the effect on the overall conclusion was judged to be insignificant and the original (Revision 0) analysis was not redone. The conclusion reached on sheet 68 is discussed in the response to item 1(a) above. The conclusion was based on the engineering assessment that there was a large margin available in the system to assure that the system would function adequately. Because of this margin, it was not considered necessary to define precise values in the original calculation.

The updated calculation performed in response to this item substantiates the original engineering approach for the above three issues.

f. This item states that the assumption of fully developed turbulent flow was not verified by the calculations, and that the IDI team performed its own calculations and determined that the original assumption was "not conservative". The originator must assume the type of flow and friction factors as part of the data input into the computer. Subsequently, the computer code checks the Reynolds number (R) and internally calculates the appropriate friction factor. For laminar flow (R less than 2100), the friction factor is 64/R. For turbulent flow (R greater than 2100), the friction factor is calculated from the Colebrook equation.

The calculated and assumed friction factors were compared by the originator to verify that they agree and that the net frictional pressure loss is conservative.

g. This item indicates that the differential pressure used in the calculations did not include documentation of corrections for pressure recovery. The calculations for this item were all performed correctly, but were not documented as part of the formal design package. The updated calculations in response to this overall item specifically address the pressure recovery and confirm the adequacy of the original design.

h. This item states that the manner of splitting flows was not "conservative," and that the loss due to reducing tees was not included in the analysis. This concern is partially answered in the response to 1(a) above, which emphasizes that the overall purpose of the analysis was not to provide precise values at any given point in the system. It is agreed that the loss in the reducing tees was not specifically included in the calculation. The loss in the reducing tees was judged to be of secondary importance and was not considered to be a factor which would change the overall conclusion. The manner in which the loss factors are split between "run" and "branch" lines was also considered to be an insignificant factor in determining overall system performance results. Nonetheless, to respond to this item, the revised calculation included the effect of the loss in the tees. The revised calculation used a more conservative approach to split the flows than the original calculation. The approach was that the total resistance was applied to the upstream leg of the tee when analyzing either a branch or a run line. The calculation verified the original engineering assessment that the system has an inherently large margin available which is adequate to absorb any effects from the loss in the tees.

i. This item questions the use of "clean commercial grade" pipe roughness factors in the hydraulic analysis. The item indicates that this assumption was not conservative because it failed to take into account deterioration of pipe surfaces over the life of the plant. The use of "clean commercial grade" pipe in the hydraulic analysis was consistent with standard industry practice. The industry practice has been to account for deterioration of the pipe surfaces over the life of the plant by providing margin in the size of the pump. Consistent with this practice, the Perry design accounted for deterioration of pipe surfaces by sizing the Emergency Service Water pumps with adequate head margin. As described in the response to 1(a) above, the small impeller has a design margin of 40 psi (at least 50% margin). Therefore, the system performance over the life of the plant will be adequate. Accordingly, no corrective action is required.

The basis section of this item (pages A-10 & A-11) lists four "violations of procedure and criteria," which form the basis for the deficiencies identified in Sections 1(a), 1(b), and 2(a) through 2(i) of the item.

First, the IDI Report references the requirement in Regulatory Guide 1.64, ANSI N45.2.11 and G/C Design Control Procedure 4.2.1, that calculations note information so that the verifier can understand the analysis and verify its results without recourse to the originator. Section 1(a) of this item is the only section which specifically references the foregoing requirement. For the reasons stated in the response to Section 1(a), the original analysis, which excluded discharge to the swale, complied with ANSI N45.2.11, Regulatory Guide 1.64, and G/C Design Control Procedure 4.2.1.

Second, the IDI Report references the requirement in G/C Design Control Procedure 4.2.1, that the cover page of each analysis/calculation shall identify all pages of the complete work. Sections 1(a) and 2(c) of this item are the only sections which specifically reference the foregoing requirement. As indicated in the above responses to items 1(a) and 2(c), the applicable cover pages did not include references to the computer runs, however, the computer runs were microfilmed with the cover pages as part of the permanent project records. The worksheets in question were not referenced because these documents were not considered to be part of the formal design package.

Third, the IDI Report references the requirement in G/C Design Control Procedure 3.6.1, that design documents be modified to comply with resolutions of the verifiers' comments. Section 2(e) of this item is the only section which specifically references the foregoing requirement. As indicated in the above response to Item 2(e), the resolution of the reviewers' comments in the three instances referenced in the item did not require modification of the applicable design documents.

Finally, the IDI Report states that there was a lack of documentation from the pump vendor to support the computer model, which was contrary to ANSI N45.2.11, requiring that the final design be traceable to the source of the design input. The pump vendor documentation issue is addressed in Section 2(b) of this item. As indicated in the above response to Section 2(b), there was an interpretation of the pump performance curve that was documented in the hydraulic analysis included in the design package. Although there was a reference omission as described above, ANSI N45.2.11 does not require the documentation of all interpretations supporting the design, and in our judgment did not require documentation of the pump performance curve interpretation covered by this item.

In summary, of the documentation inadequacies identified under this item, in our view, none represented violations of ANSI N45.2.11, and there were no serious deviations from procedures. Nonetheless, to respond to the concerns expressed in this item, the hydraulic calculations for both the Emergency Service Water and Emergency Closed Cooling Water Systems have been redone in accordance with the current G/C Design Control Procedures. The new calculations demonstrate that the original design was adequate for its intended safety function. Accordingly, no further corrective action is necessary.

D2.1-6 (Deficiency) Failure to Provide Antirotation Protection for the Emergency Service Water Pumps

Summary of Item

This item states that specific analyses were not performed to assure that the Emergency Service Water pumps are adequate to withstand additional inertia torque loads resulting from potential reverse rotation during draining of the pump column after a pump trip.

Response

No analyses of the type discussed in this item were deemed necessary at the time of the original design of the Emergency Service Water pumps, based on an engineering decision concerning the adequacy of this system to preclude the occurrence of reverse rotation. The decision was based on several factors, including pump size, piping system design, the amount of time required to drain and restart the pump, and the demonstrated ability of similar systems at other operating plants to preclude reverse rotation. We do not agree that ANSI N45.2.11 requires a calculation, or other documentation, to confirm the engineering decision.

Nonetheless, in response to this item, the Perry Preoperational Test Program (TS P45, Addendum E) has been modified to include provisions for observing the pump after a pump trip to confirm that reverse rotation will not occur during the period in which the pump could be automatically restarted.

We agree with the conclusion of the IDI Report that, because of the unique configuration of the Emergency Service Water pumps, the item does not raise a systematic issue. For this reason, and based on the other reviews and information discussed above, no further action is deemed necessary.

D2.1-7 (Deficiency) Non-Qualified Heating Provisions in the Emergency Service Water Pumphouse

Summary of Item

This item states that no provisions have been made for direct temperature indication readout in the control room to assure that the temperature in the Emergency Service Water Pumphouse will be monitored to maintain it at 40°F or higher.

Response

Instrumentation with direct readout in the control room is not required to meet the FSAR commitment of maintaining the Pumphouse at a minimum temperature of 40°F. We believe that the present Pumphouse safety-related temperature indication readout located in the control room, which utilizes the deviation from preset temperature method, is adequate to provide monitoring of the Emergency Service Water Pumphouse temperature.

The FSAR commitment is met by plant procedures (Equipment Report Sheet and Operational Administrative Procedure OAP-1702) which will be used to check the Emergency Service Water Pumphouse once per shift during the Winter. Non-operative heaters or possible low room temperature would be easily detected during these checks.

Confirmation of low room temperature will be made through the existing readout in the control room. Portable heaters would be used as required to maintain the temperature at or above 40°F to assure that the Emergency Service Water System can perform its required safety function.

No additional corrective action is required to meet the FSAR commitments.

D2.1-8 (Deficiency) System Operating Data Not Support By Design Calculations

Summary of Item

This item identifies deficiencies in the piping and instrumentation diagrams, including a lack of documentation of calculations for temperatures, temperature data inconsistencies, an inadequate verification basis, and a procedure implementation error.

Response

Our review of this item indicates that the temperatures indicated on the piping and instrumentation diagrams (P&IDs) were originally determined by informal calculations which were not retained. In some of these cases, engineering decisions were made utilizing design considerations such as ambient temperatures, differential temperatures, and approach temperatures.

Temperature data inconsistencies on the P&IDs developed as the equipment was procured and as individual temperature parameters were modified. Some parameters were changed on the drawings and others were not. These inconsistencies were not documented and corrected during verification. It is likely that the verifier did not document and correct the inconsistencies because of his decision that the inconsistencies had no effect on the design.

During the verification process of the P&IDs the various methods for selecting temperatures were reviewed and accepted by the verifier without documenting a detailed basis for the verification. At the time of the verification (approximately 1977), it was not unusual in the industry to omit this level of detail as part of verification.

In response to the above items, seventeen calculations (one for each of the balance of plant safety-related systems) have been performed to substantiate the temperature parameters on the P&IDs. The results of the calculations indicate that approximately 10% of the temperature parameters are higher than those shown on the drawings. The effects of these increased temperature parameters are being evaluated by the designers in the areas of piping analysis, building services, control systems, and equipment qualification using the revised temperature data. To date, evaluations of the temperature changes indicate no impact on the adequacy of the existing design, and that no hardware modifications are required. The P&IDs are also being corrected as required to reflect temperature parameter changes. Based on the effort completed to date, we expect the above actions to confirm the adequacy of the original methods used to determine temperature parameters. The remaining effort is scheduled to be completed by April 1, 1985.

In response to the portion of this item dealing with the failure to remove a back circle denoting a previous drawing revision, the P&IDs have also been reviewed to assure that back circles are being removed in accordance with Appendix G of the Project Procedures Manual. The P&IDs will be updated to remove back circles as the drawings are revised. The G/C Mechanical Project Engineer issued a memorandum on January 4, 1985 to responsible personnel, to reinforce the need to remove back circles from previous revisions.

The corrective actions described above will assure that there will be adequate calculations to support the temperature values listed on the operating data sheets of all safety-related P&IDs.

D2.2-1 (Deficiency) Inconsistencies and Inadequate Substantiation of Assumptions and References in Emergency Closed Cooling Water Surge Tank Sizing Calculations

Summary of Item

This item states, that there were deficiencies in Calculation P42-5 for sizing the Emergency Closed Cooling Water surge tank involving (1) lack of reference or basis for temperatures used in calculating thermal expansion; (2) no allowance for a volume of water contained in the equipment which could affect system volumetric expansion; (3) an unsubstantiated assumption for the volumes of water in fittings and valves; and (4) no identification of high and low levels in the calculation.

Response

With respect to (1) above, temperatures from P&IDs were used, but were not individually referenced in the calculations. Because the normal source of temperature data for system calculations is the P&ID, the originator did not believe that it was necessary to include individual references in the calculation. ANSI N45.2.11 does not state the extent to which specific references must be individually listed in a calculation; therefore, ANSI N45.2.11 is subject to a reasonable interpretation by the originator. In this case, we believe that the originator reasonably concluded that the specific reference to the sources of temperatures was not required.

With respect to items (2) and (3) above, the originator of this calculation did not believe it was necessary to include the volume of water in the equipment, other than for the major components, or to develop a detailed verification of the assumption of the volume of water in valves and fittings. The calculation showed an expansion of 23 gallons in a 660-gallon tank, which confirmed the large margin and justified the originator's assumptions about water volumes. The verifier reviewed the calculation and agreed that it was not necessary to refine the volume of water in small components and valves and fittings, in light of their negligible impact with respect to the overall capacity of the tank.

Despite the above, in response to items (1) through (3), Calculation P42-5 was revised to include a specific reference to the source of the system temperature, the volume of all equipment, and a detailed volume of all fittings greater than 2-inches nominal size. For smaller fittings, the piping volume was extended to the centerline of the working points. For valves, the volume was approximated as the equivalent straight length of pipe, as in the original calculation. This revised calculation showed that the volume of the equipment not included in the original calculation was 3% of the system volume. The calculation also indicated that including the detailed fitting volumes resulted in a 6% decrease in the system volume. Overall, the revised calculation, which included the above detailed considerations, demonstrated that the original assumptions were conservative and represented acceptable design practice. The calculation also demonstrated the insignificant contribution of the original assumption with regard to the overall size of the surge tank. For these reasons, the use and verification of assumptions in the original calculation for sizing the surge tank was consistent with the requirements in ANSI N45.2.11 and G/C Design Control Procedure 2.05.

Item (4) states that there was no identification of high and low water levels in the calculation to size the surge tank, and that the results of the sizing calculation could not be related to the levels identified on the setpoint list and to the water inventory requirements in the FSAR. Our response to item D2.2-2 addresses the inventory requirements in the FSAR. As indicated in the response to item D2.2-2, the setpoint list accurately describes the high and low water levels for the tank. The calculation did not identify high and low levels for the tank because the purpose of this calculation was to determine the adequacy of the size of the surge tank. In any case, as part of the response to this item, the revised calculation documented and validated the same high and low levels that were specified in the setpoint list.

The revised calculation has confirmed that the original design of the surge tank was sufficiently conservative to accommodate substantial volumetric expansion, in excess of that identified in the calculation, and that no hardware changes are required in response to this item.

D2.2-2 (Deficiency) Inconsistent Low Level Setting on Emergency Closed Cooling Water Surge Tank

Summary of Item

This item states that the FSAR was inconsistent with the calculations and level switch settings for the Emergency Closed Cooling Water surge tank.

Response

Our review confirms that the FSAR is inconsistent with the design documents with respect to surge tank inventory requirements for mitigating system leakage. An FSAR revision has been initiated to be consistent with Section 9.2.2 of the NRC Standard Review Plan, which requires a 7-day supply of water to accommodate system leakage. Based on the estimated system leakage of 0.5 gallon/hour referenced in this item, and the 7-day Standard Review Plan requirement, an 84-gallon low-level inventory is required and will be specified in the FSAR revision. The existing system design provides a low-level inventory of 220 gallons, which far exceeds the low-level inventory requirement of 84 gallons. Thus, no other corrective action and no hardware changes are required.

D2.2-3 (Deficiency) Incorrect Application of ASME Code Criteria for Sizing Emergency Closed Cooling Water System Surge Tank Vent Pipe

Summary of Item

This item states that the ASME Code was incorrectly applied in sizing the Emergency Closed Cooling Water System surge tank vent pipe.

Response

This item is based on the fact that the calculation for sizing the surge tank vent pipe used an ASME Code section applicable to vertical tanks. The item indicates that the use of that Code section was inappropriate because the surge tank is a horizontal tank. The originator of Calculation P42-7 recognized that the 1-oz/in² ASME Code criteria was for vertical tanks and not for horizontal tanks. The calculation expressly stated in two places that the Code value for vertical tanks was being used because the Code did not include a value for horizontal tanks. The originator's decision to use a design differential pressure for vertical tanks was conservative in the context in which the value was used.

Nonetheless, to respond to this item, G/C performed Calculation P42-10 to determine the maximum differential pressure which the surge tank could withstand. The calculated value of 70-psi allowable differential pressure substantiates both the originator's use and the verifier's acceptance of the 1-oz/in² criteria, and confirms the conservatism in the original analysis. For these reasons, no further corrective action and no hardware modifications are required.

D2.2-4 (Deficiency) Inadequate Documentation to Support Emergency Closed Cooling Water Heat Exchanger Size

Summary of Item

This item describes a documentation deficiency relating to the source of design input used in Calculation P42-4.

Response

This item is based on the fact that calculation P42-4 used heat loads from FSAR tables as the source of the design input. The use of the FSAR as a source for the heat loads was not technically proper and the calculation has been revised to reference the latest vendor data and the latest system performance calculations. The revised calculation has shown that the heat exchangers are conservatively sized and that no hardware modifications are required.

D2.3-1 (Deficiency) Lack of Documentation
Confirming that the High Pressure Core Spray Pump Room Cooler Is
Adequately Sized

Summary of Item

This item states that the original calculation to size the air handling unit lacked certain details, that the original calculation had assumptions that were not subsequently confirmed, and that later calculations resulted in a temperature in excess of the temperature stated in the Project Design Criteria and the FSAR.

Response

Our review of this item indicates that the documentation of the room cooler sizing lacks clarity and contains inconsistencies, but that the documentation does not call into question the adequacy of the design.

The process for determining the room cooler design for all Emergency Core Cooling System pump room coolers was a two-step process. First, initial calculations were performed between 1974 and 1976 to procure the cooler. This calculation was based on the heat load information available at that time. It was recognized that the final heat loads might differ from the original heat loads. A sizing margin was added to the capacity of the equipment to accommodate any future changes to the heat loads.

The second step of the design process was to perform final calculations in conjunction with the Equipment Qualification Program. The final calculations were performed in 1982 to conform the room temperature parameters with actual loads and the capacity of the purchased room coolers. For the High Pressure Core Spray pump room, the final calculation resulted in an increased value for the temperature in the room. At that time, all affected equipment was qualified for this increased temperature profile as reflected in Section 3.11 of the FSAR. Inadvertently, Section 9 of the FSAR was not updated at that time.

Based on the two step approach summarized above, the original sizing calculations were superseded by the later calculations. The original calculations were retained for historical purposes. The later calculations conform the as-installed air handling units with the actual heat loads and with the temperature profile used in the Equipment Qualification Program. These later calculations demonstrate the adequacy of the design.

The first concern stated in the description section of this item is that the original calculation lacked certain details, such as lighting, other installed high temperature piping, and the High Pressure Core Spray waterleg pump motor, and that the original calculation used assumptions that did not reflect certain characteristics of the procured cooler and other equipment in the room. As indicated above, the original calculations were performed to procure the coolers, and it was anticipated that heat loads might change as the design evolved. The information which this item states was improperly omitted from the original calculation was not available in sufficient detail to use. Although specific assumptions could have been made for the heat load parameters listed in this item, margin was available to cover these heat loads. The approach and assumptions made prior to the procurement of the HVAC system were consistent with standard industry practice for initial design work and procurement.

The second concern stated in the description section is that the later (1982) calculation, CL-ECA-011, resulted in a room temperature profile in excess of the design value in the original calculation. In light of the iterative process described above, there is nothing unusual about the fact that the revised calculation temperature profile was different than the original calculated temperature.

An additional concern stated in the basis section is that the original calculation assumptions were not verified and documented as the design proceeded in accordance with ANSI N45.2.11. Although ANSI N45.2.11 does not specifically address the timing of the verification of assumptions and updating of calculations as changes occur, standard industry practice has been to reconfirm the design adequacy at periodic intervals during the design process rather than to continually update these types of assumptions. As described above, the original HVAC calculations were updated in 1982 in conjunction with equipment qualification. We do not believe that this item provides a basis for concluding that the interval between the original and later calculation was so great as to constitute a violation of ANSI N45.2.11.

The impact section of this item raises the question whether the equipment has been suitably qualified for its environment. The results of the later calculations were used as a basis for the Equipment Qualification Program, and all equipment was suitably qualified to operate in the environment as determined by the later calculations. As indicated in our response to item D2.3-2, correction of the discrepancies noted in Calculation CL-ECA-011 have not resulted in a higher temperature profile in the High Pressure Core Spray pump room. The corrective action has confirmed that the equipment is suitably qualified for its environment.

To respond to the documentation concerns identified in this item, the following corrective action is being taken. The original room cooler calculations are being revised to add a reference to the later calculations; an FSAR revision to Section 9 will be made to assure consistency with Section 3; and the Project Design Criteria will be amended as required to be consistent with actual plant temperatures profiles. In addition, to address the systematic concern raised in this item, the above corrective action has been initiated for all Emergency Core Cooling System pump room calculations. Corrective action will be completed by February 15, 1985.

D2.3-2 (Deficiency) Unconservative Design Input and Assumptions Used in Calculation of the Temperature Profiles Within an ECCS Pump Room

Summary of Item

This item describes several deficiencies in Calculation CL-ECA-011, which was used in calculating the temperature profiles within an Emergency Core Cooling System pump room.

Response

We have performed a detailed review of the original documentation package for the Emergency Core Cooling System pump room temperature profile calculations with respect to the concerns identified in this item. The results of that review are summarized in the specific discussion set forth below. In addition, in response to this item, G/C has performed detailed confirmatory calculations of the temperature profiles for the High Pressure Core Spray pump room. These calculations confirm that, although the original calculation contained some deficiencies, its conclusions are valid and the present design of the HVAC system for the High Pressure Core Spray pump room is adequate.

In addition, to address any cumulative effect of issues raised by this and other IDI items related to the Auxiliary Building HVAC design, all temperature profiles for the Auxiliary Building have been recalculated. All of the new calculations have addressed the issues in the IDI's HVAC items, including: use of appropriate heat transfer coefficients for cold surfaces, the final heat loads, the proper adjacent room temperatures, the latest design drawings, and documentation of underlying assumptions. The calculations also made the conservative assumption (in response to item D2.3-3) of a loss of off-site power concurrent with a loss of coolant accident and safe shutdown earthquake, thereby rendering nonsafety equipment inoperative.

The results of the calculations show that the highest long-term temperatures are as follows:

ZONE	CONFIRMATORY CALCULATIONS	RESULTS
AB-1 HVAC Equipment Area	CL-ECA-010, Rev. 1	Decreased from 129°F to 124°F
AB-2 LPCS, HPCS Pump Room	CL-ECA-023, Rev. 0 CL-ECA-011, Rev. 1	Decreased from 154°F to 143°F
AB-3 RCIC Turbine and Pump Room	CL-ECA-008, Rev. 1	Decreased from 143°F to 138°F
AB-4 RHR Pump Rooms	CL-ECA-008, Rev. 1	Decreased from 129°F to 116°F
AB-5 RWCU Pump Room	CL-ECA-008, Rev. 1	Decreased from 258°F to 131°F
AB-6 Corridors	CL-ECA-002, Rev. 1	Increased from 105°F to 119°F
AB-7 Steam Tunnel	CL-ECA-008, Rev. 1	Decreased from 189°F to 115°F
AB-8 Piping Penetration Chase	CL-ECA-008, Rev. 1	Decreased from 136°F to 132°F
AB-9 Corridors	CL-ECA-008, Rev. 1	Decreased from 126°F to 123°F

As can be seen from this table, the recalculated temperatures for all areas, with the exception of the Zone AB-6 corridors, were lower than the values originally calculated. Equipment qualification reviews utilizing these revised temperatures have been performed. The results of these reviews indicate that the new temperatures do not adversely affect equipment qualification. A specific discussion of the issues raised in this IDI item is set forth below.

The first item lists nine concerns, the last six of which are described as "minor errors associated with proper documentation of the calculation" which "will have no impact on the design." The basis section states that the six "minor" items relate to "lack of traceability," citing Regulatory Guide 1.64 and ANSI N45.2.11. The item contains a brief description of the documentation concerns relating to each of the six minor items. Although we do not believe that the six minor items are so serious as to call into question the traceability of the package, we have corrected these documentation discrepancies.

With respect to the remaining three issues covered by this item, the first is based on item D2.3-3. Since no new facts are discussed separately in this item, our response is the same as that set forth in response to item D2.3-3.

The second item relates to a calculation of the room temperature for an adjacent room in the Fuel Handling Building following a LOCA concurrent with a loss of off-site power. The original calculation contained an assumed temperature which was subject to later verification after additional information was obtained. The item states that an instruction and procedure were violated because of a failure to clearly identify the assumption in the calculation package, in that "the specific locations where the assumption was used to calculate results were not identified nor marked within the calculation."

The procedures in effect at that time, DCP 1.20, Revision 3, and DCP 2.05, Revision 3, required that pages in which there were assumptions to be verified later be listed on the cover page and that the assumptions requiring subsequent reverification be clearly identified in the calculation. The room temperature assumption in question was clearly identified as an assumption at the beginning of the calculation and was included on the cover page. Although the assumption was not restated in "each specific location" where the room temperatures were used in the calculation, such repetition was not required to meet the applicable procedures.

As planned, later analysis was performed to calculate a precise temperature profile for the Fuel Handling Building. The results of the analysis showed that the actual room temperature was somewhat higher than the assumed value. It was determined that a recalculation was not necessary because the difference in the temperature differential of 18°F would not have a significant effect through a 3 to 4 feet thick concrete wall which covered only 200 square feet of the room's surface area of 7500 square feet. Although this was a reasonable conclusion, the item is correct that the conclusion should have been documented in the original calculation. However, action has been taken to include the Fuel Handling Building temperature profile in the revised calculation.

The last of the three remaining items state that the use of piping composite drawings to determine pipe lengths for HVAC calculations was improper. Although the piping composite drawings had not been verified, the originator correctly believed that any difference between the composite drawings and the orthographic drawings would have no significant effect on the results of the HVAC calculations. Nonetheless, we agree that the methods used were not strictly in accordance with procedures and we have used orthographic drawings in the overall corrective action for this item.

Verification of the confirmatory calculations will be completed by February 15, 1985. Further, the equipment qualification auditable file packages will be revised, as necessary, to incorporate the new temperature profiles by April 15, 1985. Based on the work to date, we do not anticipate any hardware modifications.

D2.3-3 (Deficiency) Environmental Condition Analyses Inconsistent with the Design Basis Event Postulated Inside Containment

Summary of Item

This item states that in the equipment qualification calculations it was improperly assumed that the nonsafety HVAC equipment would operate during a Design Basis Event.

Response

This item relates to Auxiliary Building room temperature profiles which were used in 1982 in the Equipment Qualification Program. The analyses assumed, among other things, that there would be a loss of off-site power following a LOCA, which would temporarily render inoperable the nonsafety-related HVAC equipment, including the nonsafety-related HVAC equipment in the Auxiliary Building. However, the calculation further assumed that a loss of off-site power would be restored within 9 hours. The item is correct that a more conservative approach would have been to assume an extended outage of the nonsafety-related HVAC equipment, rather than using 49 hours. The decision to restore the nonsafety-related HVAC equipment was based on the originator's belief that 49 hours was a reasonable amount of time to reconnect off-site power and return the HVAC equipment to operation.

In response to this item, as described in the response to item D2.3-2, all Auxiliary Building temperature profile calculations have been revised. In these calculations, a loss of off-site power was assumed to be a part of the Design Basis Event and no credit was taken for nonsafety HVAC equipment. As is evident in the results of these calculations given in the response to item D2.3-2, the original design was adequate.

In addition, an internal G/C Design Bulletin will be issued by February 1, 1985 to all design personnel to alert them to the need to consider a loss of coolant accident inside containment concurrent with a Safe Shutdown Earthquake and loss of off-site power.

D2.3-4 (Deficiency) Missing Safety-Related Mechanical Calculation

Summary of Item

This item states that Calculation CL-ECA-023 for the temperature in the Low Pressure Core Spray pump room could not be located during the Independent Design Inspection.

Response

Calculation CL-ECA-023 has not been found. We assume that the original calculation was misplaced in the process of converting the hard copy to microfilm. Another calculation having the same calculation number has been made, which substantiates the temperatures in the Low Pressure Core Spray pump room. As noted in this item, this is not a systematic concern. No further action is required.

D2.3-5 (Deficiency) Inadequate HVAC Calculations to Confirm Temperature Profiles in Zone AB-4 Following a LOCA Inside Containment

Summary of Item

This item describes deficiencies in the calculations made to determine the temperature profiles in the Residual Heat Removal pump rooms.

Response

The item first describes deficiencies in Calculation CL-ECA-008 for three subzones of Zone AB-4, the Residual Heat Removal pump rooms. For each of the subzones the item indicates that nonsafety-related HVAC systems were assumed to be operating. We have addressed this item in our response to item D2.3-3.

This item states that certain heat loads for Residual Heat Removal System components (pumps, heat exchangers, and piping) were not included in Calculation CL-ECA-008. The reason that the system heat loads were not included in the calculation is that the purpose of the calculation was to determine the long-term temperature in the pump rooms following an accident. As such, it was conservative to assume that the Residual Heat Removal System was not in operation. This is because, in the long-term, the Residual Heat Removal System temperatures are below room temperature, and the heat absorbed by the "cold" system piping, the heat exchangers, and the pump room coolers exceeds the heat given off by the Residual Heat Removal pump motors. The reanalysis performed in response to item D2.3-2 covers this item.

The item states that for two of the subzones, the waterleg pump motors were not identified as heat loads. These heat load omissions involved a minor mistake which has been corrected in the revised calculations in response to item D2.3-2.

The item states that for one of the subzones, the safety-related cooler was assumed not to be running. This was a conservative assumption because it reduced the level of available cooling.

The item states that for two of the subzones, high containment zone temperatures were not used in calculating temperatures in these adjacent subzones. The adjacent containment temperatures cited are transient temperatures and are not applicable to calculating long-term temperatures in the subzones.

The item states that for two of the subzones, there were incorrect references to piping not located in those subzones. Including these heat loads was incorrect, but conservative to the overall analysis.

The last AB-4 subzone deficiency cited is that there was a failure to include heat loads from the main steam isolation valve leakage condensate piping heaters as post-LOCA heat loads. The heaters represented small, intermittent heat loads and as such are not considered in the original or revised calculation.

After listing the above stated concerns, the items states that:

> the team concluded that the post-accident condition analyzed does not represent the condition expected immediately after a LOCA, but rather a condition expected in the extreme long-term when safety-related equipment has been secured and nonsafety-related equipment restored to operation.

This correctly characterizes Calculation CL-ECA-008. The only deficiency was assuming availability of nonsafety-related equipment, as acknowledged in our response to item D2.3-3.

As stated later in this item, Calculation CL-FCA-020 calculates transient temperature conditions immediately after a LOCA. In the same context, the item states that the calculation did not document the basis of the assumption that the Residual Heat Removal System would not be required once the long-term room temperature (129°F) was reached. As indicated above, the decision not to include heat loads from the system was conservative.

The item further states that Calculation CL-ECA-008 contained a note stating that the coolers may be undersized. The note was appropriately addressed through Engineering Change Notice (ECN) #20938-51-21, dated May 30, 1984, which was issued prior to the IDI. The ECN provided additional insulation to piping within the Residual Heat Removal pump room.

The item next states that Calculation CL-ECA-020, the basis for transient temperature conditions immediately after a LOCA, does not bound the post-LOCA condition. The basis given for this conclusion is that heat loads were not included in the calculation for the Suppression Pool Cooling Mode of the Residual Heat Removal System, and that assumptions about the availability of nonsafety-related HVAC equipment during the post-LOCA transient were improper.

In response to the first point, the originator was aware that post-LOCA cooldown of the suppression pool in the Suppression Pool Cooling Mode would take longer than normal cooldown in the Shutdown Cooling Mode of Residual Heat Removal. However, considering the total amount of long-term heat expected in the Suppression Pool Cooling Mode and the peak temperatures that would be expected during the Shutdown Cooling Mode, he made the assessment that the peak temperature case would bound the post-LOCA cooldown condition. The revised calculation performed in the response to item D2.3-2 will include a specific calculation to verify the adequacy of this assessment.

The second point discusses two cases that were used in the calculation of transient temperatures. The first case, which assumed availability of nonsafety-related HVAC equipment, was an appropriate case for analyzing normal shutdown. The second case, which assumed no availability of nonsafety-related HVAC equipment, did cover the post-LOCA conditions. The fact that the temperature calculated in the second case exceeded 140°F is not significant because the higher temperature calculated was used for equipment qualification. See the response to item D2.1-3.

For the reasons given above, we do not believe that the concerns identified in this item call into question the overall traceability of the original calculation package, including the adequacy of the equipment qualification temperatures following a LOCA.

In response to all of the above concerns, calculations CL-ECA-008 and [illegible]-ECA-020 have been revised to address all concerns discussed in this item and related items of the IDI Report. The revised calculations confirm the adequacy of the original calculations, and have shown that the coolers are adequately sized and that the calculations provide an adequate basis to which the equipment in the room is qualified. No hardware modifications are required and no action other than verifying the revised calculations is required.

D2.3-6 (Deficiency) Unconservative Heat Transfer Coefficients

Summary of Item

This item describes a concern with the heat transfer coefficient which was used to determine heat losses to cold piping.

Response

This item correctly identifies two unconservative aspects of Calculation CL-ECA-020 relating to heat transfer from hot air to cold piping, including the use of an improper application of a heat transfer coefficient, and the failure to account for anti-sweat insulation on the cold piping in the calculation. Both of these items represent inadvertent errors by the originator.

As part of the overall response to the HVAC-related IDI items, all Auxiliary Building temperature profile calculations have been revised (see the response to item D2.3-2). These revisions use a heat transfer coefficient of 0.6 BTU/hr.-°F-ft^2. As noted in our response to item D2.3-2, the confirmatory calculations have shown that the original calculations for all Auxiliary Building temperature profiles, with respect to documented basis and design detail, were very conservative. All Auxiliary Building room coolers are adequately sized and no hardware modifications are required.

D2.3-7 (Deficiency) Unconservative Input and Assumptions Used In Calculation of Environmental Conditions in Zone AB-6 of Auxiliary Building

Summary of Item

This item states that there were unconservative inputs and assumptions used in the calculation of the temperature profile for a corridor (Zone AB-6) of the Auxiliary Building.

Response

All but one of the concerns described in this item have been addressed in our responses to other HVAC-related IDI items (see responses to items D2.3-1, D2.3-2, D2.3-3, D2.3-5 and D2.3-6).

The only new concern described in this item is that Calculation CL-ECA-002 neglects the effects of heat that would be transferred from the Turbine and Radwaste Buildings through "adjacent walls" into the Auxiliary Building corridor.

In the area in question, there is space between the Turbine and Radwaste Buildings walls and the adjacent walls of the Auxiliary Building corridor which minimize any significant heat transfer from the Turbine and Radwaste Buildings. Accordingly, it was appropriate to assume, for purposes of this calculation, that the corridor walls adjacent to the Turbine and Radwaste Buildings would have no effect on the temperature within the corridors.

The item indicates that correction of the first five deficiencies involving nonconservative assumptions will not significantly increase the post-accident room temperature, except for the case of the zone temperature during the plant abnormal condition caused by loss of off-site power. Our calculations in response to this and related HVAC items confirm this and show that the temperature increases for the loss of off-site power case do not cause the temperature in other adjacent rooms to rise.

D2.4-1 (Deficiency) Jet Impingement Methodology Differs from an Established Department Procedure

Summary of Item

This item states that the method used to evaluate jet impingement is contrary to G/C Mechanical Engineering Department procedure.

Response

This item is based on an interpretation of G/C's Mechanical Department Procedure No. 0254-2.8. The procedure states that the area review results in a "list of equipment hit by the postulated jet." The intent of the procedure is to require a list for all targets not previously designed to withstand the jet loads. We agree that the procedure should be clarified to state that the targets already designed for jet loads need not be listed. The reason these targets need not be listed is that they are already designed to withstand jets loads. In response to this item, the Mechanical Department Procedure 0254-2.8 has been revised to clarify the intent of the procedure.

No further action is required, since under the original design all components required to function during a pipe break have either been designed to withstand any jet loads they are subjected to or they have been shielded.

D2.4-3 (Deficiency) Design Control Procedural Errors in AEA Calculation 2.5.2.1

Summary of Item

This item states that G/C Calculation 2.5.2.1 contains three procedural discrepancies, including a reference omission for one value, a failure to verify certain pages of the calculation, and the reference of a non-scaled General Electric drawing.

Response

This item states that there were three procedural errors in G/C Calculation 2.5.2.1. First, the internal diameter of a flow restricting orifice was included in the calculation with a reference to the mechanical discipline as a source of orifice diameter. The extent of traceability to meet ANSI N45.2.11 was determined by the originator to be adequate. Second, the item correctly notes that two pages of the calculation were not signed off by the verifier. This was an inadvertent error and has been corrected in the revisions discussed below. Third, the IDI Report states that unscaled General Electric drawings were used to determine pipe lengths. Although the calculation does reference an unscaled General Electric drawing, it is stated in the calculation that the dimensions were approximate values. This was deemed acceptable at the time by the originator and verifier because the calculation involves choked flow, and therefore, is not sensitive to the pipe lengths. The exact value of pipe lengths was not considered to be a critical characteristic requiring documentation to meet ANSI N45.2.11.

In response to this item, several actions have been initiated. The calculation package has been revised to add the references used for input. In addition, the entire package has been reverified. This reverification confirms that the original input to the calculation was appropriate.

To address the IDI concern that this issue may be systematic, all other safety-related Applied Engineering Analysis Calculations for Perry have been reviewed to determine whether any of them had portions excluded from verification. The results of this review confirm that the exclusion of a portion of Calculation 2.5.2.1 from verification was an isolated incident and did not occur in any other Applied Engineering Analysis safety-related calculations. In light of the above, no further analyses and hardware modifications are required.

D2.4-4 (Deficiency) Pipe Displacement Drawings Prepared Without Appropriate Design Controls

Summary of Item

This item indicates that the pipe break and jet displacement study (Jet Study) was conducted on-site using unchecked drawings and informally documented information.

Response

ANSI N45.2.11 requires that adequate documentation and verification of design activities be performed, but does not specifically address the timing of such documentation and verification. G/C Design Control Procedures are more restrictive than the ANSI standard in that they require that design documentation and verification be performed prior to release for construction, fabrication or procurement. In the Jet Study, the drawings and pipe displacement information discussed in the IDI Report were used to develop jet target lists, which in turn were used as input to determine specific jet shielding requirements. The Jet Study was nearing completion at the time of the IDI in August, 1984. The verification process for drawings and design information had not been accomplished, but was planned to be completed in accordance with G/C procedures. A few hardware related changes were released for construction. However, the changes could not have resulted in an unconservative design.

The on-site Jet Study work packages, including drawings, are still in the process of being documented and verified. Original target lists are being verified for accuracy per G/C Design Control Procedures by physical walkdown in the plant. In addition, interfacing discipline system drawings are being re-evaluated to confirm that components not yet installed are included on the target list as required. All documentation and verification work will be completed by February 1, 1985. Verification of the Jet Study effort will provide assurance that adequate protection is provided for the effects of postulated high energy line breaks and that the documentation of the effort is consistent with G/C Design Control Procedures.

D2.4-5 (Deficiency) Deviation From a Technical Approach With Respect to Jet Impingement Envelopes

Summary of Item

This item states that the method used in the pipe break and jet displacement study (Jet Study) to determine increases in jet impingement envelopes due to pipe displacements potentially excluded some targets which should have been included.

Response

We concur with the IDI Report that the potential exists for missed targets in the discontinued band (See Figure 1) due to the methodology used. The impact, however, of not investigating for additional targets in the discontinued band is considered insignificant based upon the following:

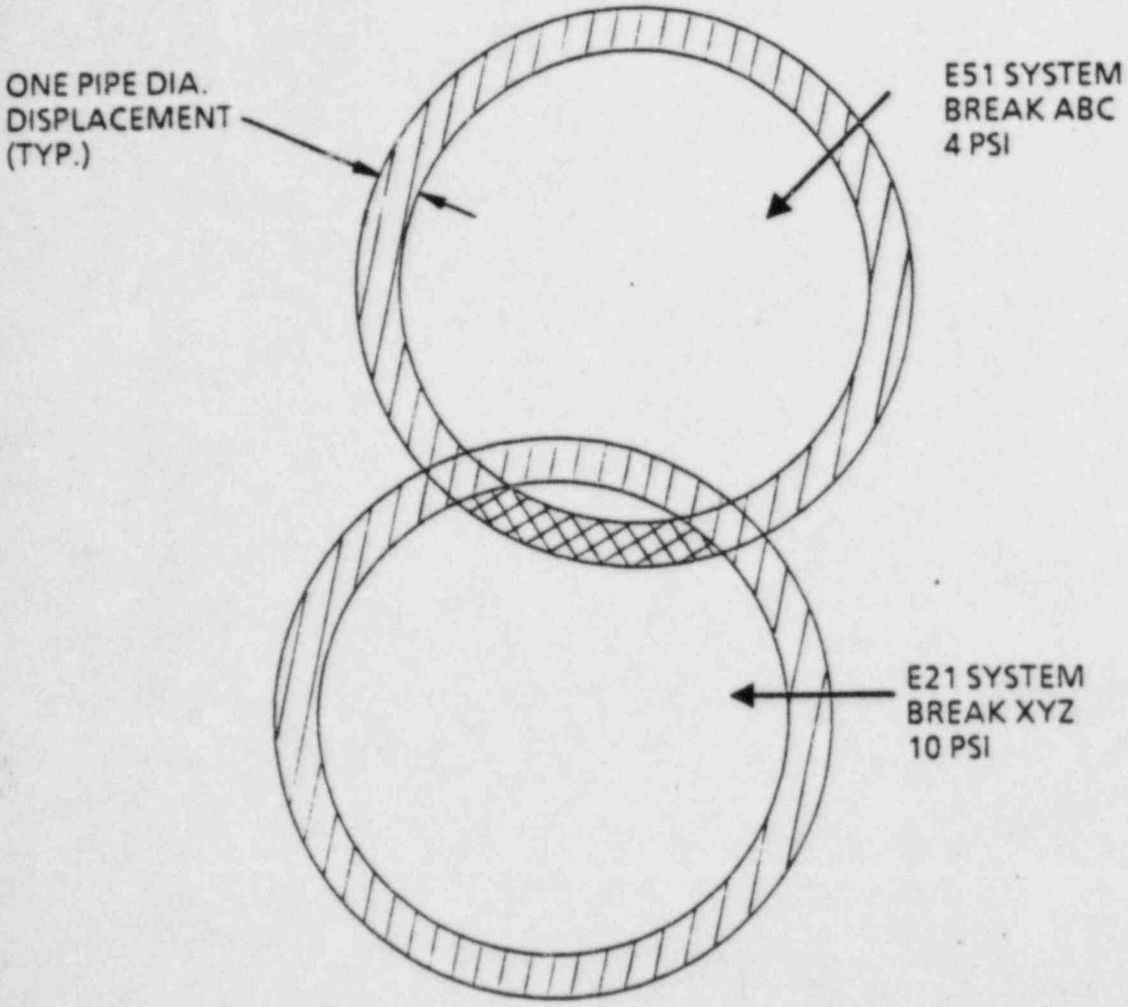
1. Approximately 50% of the jet impingement envelopes do not have any overlap, or the overlap is from breaks within the same piping system, so the higher pressure jet will be the limiting design case.

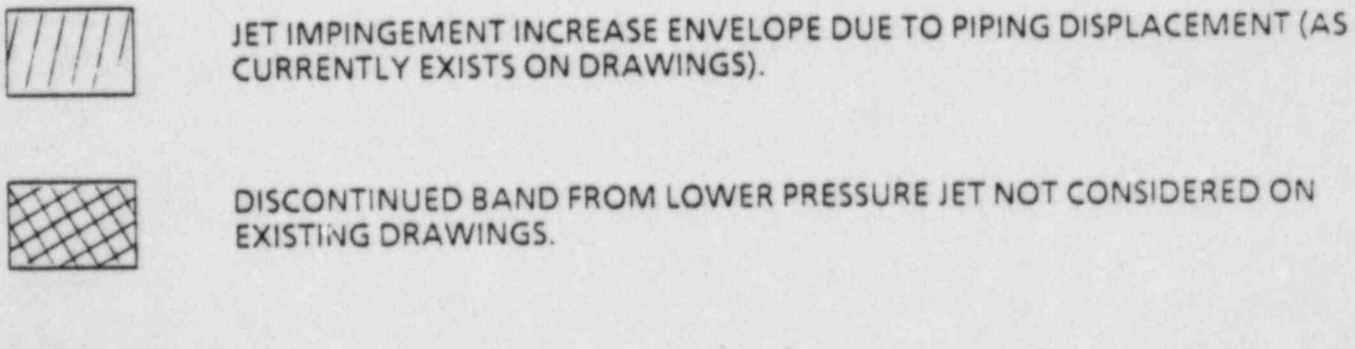
2. For the remainder of the jet envelopes, the actual physical area of the discontinued band in relation to the full jet envelope is typically very small. Figure 1 is representative of this relationship. As a result, there is a low probability of a safety-related component being located totally within this excluded zone. Thus, structures, systems, and components are still appropriately protected against any discharging fluid from a ruptured pipe, as required by 10 CFR, Part 50, Appendix A.

However, in response to this item, all the Jet Study drawings will be reviewed to identify any safety-related targets located in discontinued band zones not previously identified. This corrective action will be completed by February 1, 1985. For the reasons stated above, it is not expected that any new targets will be identified.

FIGURE 1

NOTE: ILLUSTRATION ONLY





D2.4-6 (Deficiency) Failure to Identify Increased Jet Impingement Envelope Due to Pipe Displacement

Summary of Item

This item states that the required one diameter pipe displacement was not shown on an elevation drawing used in the pipe break and jet displacement study (Jet Study), and that the drawing was not checked.

Response

As discussed in the response to item D2.4-4, ANSI N45.2.11 does not specifically address when verification should be performed. The Jet Study was nearing completion at the time of the IDI, and drawings, including the drawing addressed in this item, had not yet been checked. The IDI Report notes that the one diameter pipe displacement, although not shown on the elevation drawing, was correctly shown on the plan drawing for Feedwater Break WB6LL. Both drawings were necessary to define the jet envelope when investigating for targets. The inconsistency between the two drawings was evident and the proper one pipe diameter jet displacement was in fact considered for Feedwater Break WB6LL. Therefore, the omission of information from the elevation drawing had no impact on design.

As discussed in the response to item D2.4-4, the Jet Study work packages, including drawings, are in the process of being verified in accordance with G/C Design Control Procedures. The verification includes checking for jet envelope enlargement due to pipe displacement. As part of this verification process, the drawing for Feedwater Break WB6LL has been corrected to show the proper displacement. No further action in response to this item is required.

D2.4-7 (Deficiency) Jet Impingement Envelopes Not Increased Due to Pipe Displacements

Summary of Item

This item indicates that the jet patterns on the pipe break and jet displacement study (Jet Study) map drawings for Main Steam breaks SA3C, SB3C, SC3C, and SD3C were not revised to account for the predicted pipe movement during rupture.

Response

Due to the large number of postulated breaks in the area of the four main steam line breaks referenced above, large scale study sketches were made. These study sketches were used in lieu of the jet map drawings for identifying areas to be investigated for safety-related targets. The large scale sketches showed the effects on jet patterns of pipe displacement from main steam line breaks. Because the sketches were actually used for target identification, it was not considered necessary to revise the jet map drawings themselves to show pipe displacement effects. There was no procedural or other requirement which mandated updating and using the jet map drawings as opposed to the study sketches.

We agree with the IDI Report that jet impingement loading onto a target is a function of distance from the break, angle of incidence, and thrust force. However, it was not a purpose of the onsite Jet Study work to define specific jet impingement target loadings. The purpose of the Jet Study was to identify additional safety-related targets impacted by ruptured pipe or located within increased jet envelopes resulting from ruptured pipe movement. Targets identified by the Jet Study were subsequently evaluated to determine whether the targets are required to function for safe shutdown of the plant. Targets required to function for safe shutdown were then further evaluated to determine whether the target was adequate as designed, or whether hardware modifications or jet shields were necessary. Jet impingement target loadings were defined by the appropriate discipline personnel as part of these detailed evaluations. Loadings were defined taking into account distance from the break, angle of incidence, thrust force, and other pertinent design information.

In summary, the fact that the jet map drawings for Main Steam breaks SA3C, SB3C, SC3C, and SD3C were not revised to account for pipe displacement was consistent with the limited purposes of the Jet Study. Failure to revise the jet map drawings had no impact on the overall analysis of whether identified targets were capable of withstanding jet impingement loads to which they might be subjected, as committed to in the FSAR. Nonetheless, in response to this item, the jet map drawings for the four breaks discussed above will be revised to show the increased jet envelopes resulting from pipe displacement. This corrective action will be completed by February 1, 1985.

D2.5-1 (Deficiency) Inadequate Interface Review for Engineering Change Notice Affecting Safety-Related System Operation

Summary of Item

This item states that an interface review by the Building Services or Mechanical Engineering discipline was not noted on Engineering Change Notice (ECN) 23377-86-576, which implemented a change to the operation of a safety-related HVAC system.

Response

We believe Project procedures were met in the implementation of the design changes covered by this item. The Perry Project Manual, Appendix N, requires an interface review of ECNs by engineering disciplines affected by the design change. Whether an interface review is necessary is determined by the ECN originator and verified by the design reviewer. The ECN addressed in this IDI item was initiated to correct an inconsistency between electrical drawings and system design drawings. The change was requested in Field Question 39170, which was initiated by the Start-up and Test Building Services group, directed to the System Engineering Response Team (SERT) Building Services group, and referred to the SERT Electrical group. The ECN was written by an engineer in the SERT Electrical group.

Because the ECN was initiated at the request of the SERT Building Services group, and because the electrical modification was made to be consistent with the existing system function, the originator and design reviewer of the ECN decided that an interface review by the SERT Building Services group of the electrical ECN was not required. The Field Question number was noted on the ECN.

Nonetheless, in response to this item, we have obtained the SERT Building Services interface review initials on the referenced ECN. We agree that this item has no impact on design. No further action is required.

D2.5-2 (Deficiency) Interface Review and Design Verification of Engineering Change Notice 22140-85-292

Summary of Item

This item states that Engineering Change Notice (ECN) 22140-85-292, Rev. A, did not have a sufficient description of the change, did not have a review by interfacing disciplines, and was verified by a site engineer without access to pertinent background information.

Response

The ECN addressed by this item concerns a design change to a platform support pipe column which allows the column to shear at the platform connection in the event of a Main Steam line break, thus assuring the integrity of the platform. The purpose of the ECN written by the site engineer was to implement construction of this design change, not to document the design basis for the change. The design basis for the change and verification of that basis were documented in the G/C calculation prior to sending the detailed design change information to the site for construction release by ECN. Therefore, interface review at the site was not needed. Further, verification of the ECN by the site design reviewer was properly limited to consistency of construction details. For this purpose, the description of the change was adequate, and no additional background information was required.

However, in the process of performing the calculations a detailed assessment of potential interaction effects of the sheared platform column was not performed. We agree that such an analysis should have been done. In response to this item, a detailed evaluation considering potential interaction effects will be performed and documented. Corrective action will be completed by March 1, 1985.

D2.5-3 (Deficiency) Use of Incorrect Revision of Controlled Drawing by Contractor

Summary of Item

This item states that there was a procedural error in drawing distribution that resulted in a contractor using incorrect drawing revisions.

Response

As discussed in the IDI Report, the electrical contractor issued a request to "turn off" distribution of SS511 series drawings. This request was erroneously entered as a request to stop distribution of all D511 series drawings to the electrical contractor. Because all but two of the 511 series drawings are "D" size (only one of the 511 series drawings is an "SS" size), the data entry operator assumed that the request applied to "D" size drawings.

This procedural error had no impact on design. The 511 series drawings are Reactor Building structural steel drawings used by the electrical contractor for information only in preparing the conduit routing drawings. The drawings are used to avoid interferences with structural steel and to locate attachment points for conduit supports. Since the conduit design team working on-site did this layout work, they had access to the Reactor Building and located the conduits and conduit supports based on actual field measurements.

In response to this item, the following corrective actions have been taken:

(1) A listing of all 511 series drawings was obtained from data entry and the drawings on the electrical contractor's stick file were compared to this listing to determine which drawings were the wrong revision. As stated above, the drawings which were used did not affect the design of the conduit and no design changes had to be made.

(2) A memorandum was sent to data entry on September 25, 1984 to again place the electrical contractor on controlled distribution of the D511 series drawings.

In light of the above, no further actions and no hardware modifications are required in response to this item.

O2.4-2 (Observation) Interaction of Nonsafety-Related Structures and Components on Safety-Related Structures, Systems and Components Following Jet Impingement Loadings

Summary of Item

This item recommends that G/C consider ANSI/ANS 58.2 (1980) probabilistic analysis and screening criteria to identify areas where nonsafety/safety interactions would be most significant.

Response

As noted in the basis section of this item, "[t]here is no FSAR commitment to evaluate interaction of nonsafety and safety structures, systems and components with regard to jet impingement effects." G/C has designed certain large structural components, such as platforms and grating, to withstand jet impingement. This has not been done to meet a regulatory requirement. ANSI/ANS 58.2, referenced in this item, contains voluntary standards relating to pipe rupture analysis. One section of ANSI/ANS 58.2 contains a general recommendation that secondary effects of pipe ruptures be evaluated. Perry has not committed to ANSI/ANS 58.2, which was issued after the pipe rupture design basis was established at Perry. We do not agree that the secondary effects section of ANSI/ANS 58.2 describes "industrial practice." We do not believe that additional voluntary analysis in this area is justified. Accordingly, there are no plans to undertake further analysis.

3.2 MECHANICAL COMPONENTS

Set forth below are our item-by-item responses to the mechanical components Deficiencies, Unresolved Items, and Observations identified in the IDI Report. The number and title of each item are taken directly from the IDI Report.

D3.1-1 (Deficiency) Unconservative Fluid Operating Temperature in Stress Analysis

Summary of Item

This item states that the design temperature of 80°F specified for the Lake Erie water is unconservative, since it is based upon the maximum anticipated temperature, rather than upon some more frequently occurring intermediate temperature value which will cause a higher thermal gradient (differential).

Response

The use of the design temperature of 80°F for the Lake Erie water, in this case, did not result in the most conservative thermal differential. The selection of 80°F was based on the fact that, generally, the maximum temperature results in the maximum thermal differential. This was not the case in the Emergency Service Water System because of its exceptionally low maximum operating temperature. Also influencing the selection of the 80°F temperature is the fact that significant thermal stresses are usually limited to higher temperature systems (greater than 150°F), since pipe routing has sufficient flexibility to permit the small thermal expansion associated with lower temperature systems.

To respond to this item, a detailed evaluation was performed to determine the worst case thermal differential for this system. Based on a winter ambient temperature of 67°F and the minimum lake water temperature of 33°F, the resulting thermal differential is 34°F. This worst case differential was used in a reanalysis (1P45G20A, Revision 4) of the Emergency Service Water piping subsystem covered by this item. The reanalysis used all worst case dynamic loads (faulted condition) and the resulting stresses are less than code allowables. All component stresses and nozzle stresses were acceptable without hardware modifications.

A review of all systems where low temperature could govern the analysis is being performed to assure this was an isolated case. This review is scheduled to be completed by May 1, 1985. No hardware changes are anticipated because piping analysis is not normally sensitive to small thermal differentials as in the case of the Emergency Service Water System.

D3.1-2 (Deficiency) FSAR Commitment

Summary of Item

This item identifies an apparent discrepancy between the piping design specifications for the Emergency Service Water and Residual Heat Removal Systems and the FSAR commitment to model equipment in sufficient detail in order to represent dynamic behavior.

Response

The design specifications covered by this item were not consistent with the referenced FSAR requirement. The FSAR sections require non-rigid equipment (equipment with a fundamental frequency less than 33 Hz) to be included in seismic analyses. G/C was aware of the FSAR commitment, and consistent with industry practice, included a recommendation in the procurement specifications that equipment be designed rigid where possible. The design specifications were based on the procurement specifications. The problem is that in some cases vendors were not able to supply rigid equipment. Although G/C had reviewed some equipment prior to the IDI to assure that the equipment had been correctly modeled, this review did not address GE and HVAC equipment. In response to this item, a program has been initiated to accomplish this review. We expect to complete this review by March 15, 1985. When the review is completed, the design specifications will be revised to reflect actual equipment frequencies. Based on the reviews conducted to date, it is not expected that hardware modifications will be required.

D3.1-3 (Deficiency) Heat Exchanger Nozzle Loads (Faulted Condition)

Summary of Item

This item concerns interpretation of a GE requirement to include thermal loads when evaluating the Residual Heat Removal (RHR) heat exchanger nozzle loads for faulted conditions.

Response

An FSAR table applicable to GE equipment indicates that thermal piping loads are included in the evaluation of heat exchanger nozzle loads in the faulted condition. The G/C design specification referenced in this item did not assure that the interface loads supplied by G/C to GE applicable to the heat exchanger nozzles considered thermal expansion in the faulted condition. The reason this occurred is that G/C's specification was written using standard piping load combinations specified in the ASME Code. The Code does not require use of thermal expansion in the faulted condition. Applying the GE requirement in this case would have been more conservative than applying the ASME Code.

In response to this item, G/C has re-evaluated the RHR heat exchanger nozzle loads using thermal expansion values for the faulted condition. The re-evaluation (Calculations P315 and P316) confirms that the nozzle loads, including thermal loads in the faulted condition, are acceptable. Although acceptance of these nozzle loads needs to be confirmed with GE, no hardware modifications are expected. Upon receipt of GE confirmation, the design specification will be updated. This action is scheduled to be complete by February 15, 1985.

Re-evaluation of other GE equipment is discussed in our response to D3.2-5.

D3.1-4 (Deficiency) RHR - Natural Frequency

Summary of Item

This item states that an incorrect value was used in the FSAR to describe the natural frequency of the Residual Heat Removal (RHR) heat exchangers, which resulted in inadequate modeling of the heat exchangers.

Response

Our review of this item indicates that the heat exchanger natural frequency (greater than 33 Hz) indicated in the FSAR was incorrect. The natural frequency was calculated by General Electric in the original design of the heat exchangers. Subsequent calculations indicating lower natural frequencies were not reflected in the FSAR. It is probable that the FSAR verification program, which was initiated prior to the IDI, would have identified and corrected this FSAR discrepancy.

In response to this item and in conjunction with our response to item D3.2-5, a reanalysis (Calculations P315 and P316) of the RHR piping system has been performed. The reanalysis, which included a detailed model of the heat exchangers and interconnecting piping, has confirmed that the piping stresses and nozzle loads are acceptable.

A change to the FSAR will be initiated by February 1, 1985, to include the GE recalculated natural frequencies.

D3.2-1 (Deficiency) Use of Unconservative Thermal Gradient in Stress Analysis

Summary of Item

This item indicates that the thermal gradient (differential) used in the piping analysis of the Emergency Service Water (ESW) System was incorrect and unconservative.

Response

This item states that the calculation for thermal differential should have used the maximum air ambient temperature (104°F) from Table 6 of the design specification. In calculating the thermal differential in the Emergency Service Water Pumphouse, G/C used 70°F as the value for ambient temperature prior to actual ambients being calculated. This is consistent with standard industry practice.

Nonetheless, to respond to this item and other items in the IDI report, a detailed analysis of the ambient temperatures and the associated fluid operating temperatures was performed. In this analysis, rather than using a standard 70°F value in determining the thermal differential, G/C calculated actual ambient air temperatures based on seasonal variations and the corresponding operating modes of the system. The thermal differential resulting from this calculation was used in a reanalysis (1P45G20A, Revision 4) of the piping system. All resulting component stresses and were within ASME code allowables. The results of this analysis confirm that the selection of thermal differential rarely controls the results of the design and analysis for low operating temperature systems (less than 150°F). No additional corrective action or hardware modifications are required.

D3.2-2 (Deficiency) Equipment Thermal Growth

Summary of Item

This item states that the piping analysis model did not properly account for thermal loads on piping due to equipment thermal growth.

Response

The originator made an error while developing the piping analysis model. This error was discovered during the verification process and was considered to be insignificant. The correct thermal growth is 0.0026 inches instead of 0.0004 inches, a difference of 0.0022 inches. The engineering decision was that two-thousandths of an inch is insignificant on piping fabricated to a tolerance of 1/8". The revised model (Calculation 1P45G20A, Revision 4) used to respond to items D3.2-1 and D3.3-2 includes the pump and strainer thermal growth, and confirms the verifier's engineering decision. For these reasons, no further analysis and no hardware modifications are required in response to this item.

D3.2-3 (Deficiency) Ball Joint Rotation Control, G/C

Summary of Item

This item states that the G/C originator was not made aware in the design input of either the rotational limit of the ball joints in G/C-analyzed systems or the piping installation contractor's installation tolerance. The item further states that the originator did not evaluate the rotation of the ball joints in the analysis.

Response

The originator was aware of the rotational limit of the ball joints. As noted in this item, the G/C System Design Specification (DSP-B21-4549-00) documented the requirement for limiting the total angular rotation to 15 degrees. Because this Design Specification was included as a reference in the design input record, there was no need to separately document the specific ball joint rotational limitations.

Although a specific evaluation was not documented, the spacing of the ball joints reflects adequate consideration of the ball joint rotation.

Nonetheless, in response to this item, G/C has performed an analysis (Calculation 1B21G03A, Revision 4 and 1B21G04A, Revision 3) for each line containing ball joints. This analysis released the moments at the three ball joints in order to provide a conservative estimate of rotation at the ball joints. Results of this analysis confirm that joint rotation is within 4.5 degrees.

In addition, a field inspection has been completed. The results of this inspection confirm that the total rotation from field alignment and service conditions is less than the allowable rotation. Therefore, no further action or hardware changes are required.

D3.2-4 (Deficiency) Ball Joint Rotation Control, GE

Summary of Item

This item indicates that there was no documented GE analysis comparing the amount of rotation predicted for ball joints with the flexural rotation limitations of the ball joints, and that compliance with the applicable GE installation requirements was not specifically inspected and documented.

Response

With respect to the first part of this item, GE did analyze the amount of expected ball joint rotation, taking into account factors such as plant layout and thermal gradients. A decision was made, but not documented, that the 4.5 degrees flexural rotation allocated for design would be sufficient for expected operating conditions. The absence of detailed supporting documentation for thi item is explained by the general industry approach to design documentation at the time the original decision was made approximately 10 years ago.

In response to this item, GE has performed and documented a detailed analysis described in GE Plant Piping Design Memo #123-8418, which confirms that the allowable rotation of 4.5 degrees would not be exceeded by predicted rotation during operation.

With respect to the second part of this item, there was no specific inspection checklist item covering the installation limits set forth in the installation instruction. To assure that the tolerance in the installation instruction was not exceeded, a representative sample of the ball joints has been inspected in response to this item. This inspection determined that the ball joints were installed in accordance with the installation requirements.

In light of the above, no further corrective action is required.

D3.2-5 (Deficiency) Interface Between Piping and Equipment

Summary of Item

This item states two concerns with respect to interfaces between G/C-designed piping and safety-related equipment. These concerns relate to possible seismic effects of flexible equipment on piping, and failure to include thermal effects in the loading combinations used to evaluate NSSS equipment nozzles for emergency and faulted conditions.

Response

The first concern is that there was a failure to include flexible equipment (equipment with a fundamental frequency less than 33 Hz) in the seismic analyses for piping. As stated in our response to item D3.1-2, G/C was aware of the potential effect of low equipment frequency prior to the IDI and had initiated a program to evaluate its effect on the attached piping. All equipment specified by G/C in the table referenced in this item had already been evaluated by this program and was determined to be acceptable. The equipment identified on the table as having been specified by GE was not evaluated.

As stated in the response to item D3.1-2, an evaluation of GE equipment is being performed. It is expected that hardware modifications will not be required as a result of this evaluation. In the evaluation to date, in some cases it was determined that a reanalysis using a flexible model was unnecessary. In the remaining cases, a reanalysis using a flexible model was performed and showed that there was no significant effect on the results of the original analysis.

The second concern is that there was a failure to include thermal loading in emergency and faulted conditions for GE (NSSS) equipment. Although the ASME code does not require inclusion of thermal loading for the faulted contition, we agree that GE's criteria, which is more conservative than the code, was not met. In response to this item, G/C has reviewed all GE equipment attached to G/C-analyzed piping. Excluding the Residual Heat Removal (RHR) heat exchangers, which are addressed in D3.1-3, there are a total of eleven safety-related pieces of equipment containing 22 nozzles with G/C-analyzed piping attached. Nozzle loads have been recalculated (Calculation P323) to include thermal loading in the emergency and faulted conditions. All but one of the nozzles have met the established interface load allowable. One nozzle on the RHR pump exceeds the allowable by 12%. GE is currently evaluating this condition. No hardware modifications are expected to be required based on GE's conservative method of establishing faulted nozzle load allowables. Our evaluation is scheduled to be complete by February 15, 1985.

D3.2-6 (Deficiency) Safety Valve Discharge Line Anchor Loads

Summary of Item

This item states that the calculation documenting the G/C review of revised piping anchor loads is not acceptable because there is no documentation of the resolution of GE and G/C loads into a common coordinate system.

Response

For the calculation reviewed (1B21-H016), G/C did not resolve the GE and G/C anchor loads, because of a pending revision of the loads. In evaluating the effects of the revised loadings on the anchor for Revision 3 of the analysis, the G/C originator did not resolve the loads because he was informed that the Revision 3 loads were overly conservative and would be changed in an upcoming Revision 4. The originator concluded that the existing design would not be affected by the revised loads, but left the detailed analysis of those loads to be done formally in Revision 4. Revision 4 has been completed, including resolution of components. Review of the Revision 4 loads confirms that the current design is adequate.

With respect to the anchor on the other discharge line mentioned in the IDI report, a review of existing documentation has confirmed that resolution of components was performed, and that the design is adequate. In light of the above, no further action on this item is required.

D3.3-1 (Deficiency) Modeling Procedures

Summary of Item

This item states that there was a failure to observe an input restriction in the use of the PIPDYN computer program which indicates the need for reanalysis of the piping to assure that nozzle loads acting on Emergency Service Water (ESW) pumps do not exceed vendor allowables.

Response

There was an inadvertant error in applying the PIPDYN code in this instance, but it was not technically significant. The originator of the analysis in question attempted to displace a boundary joint to simulate the .0015 inch thermal growth of the Emergency Service Water strainer. The originator also represented the boundary joint as a spring. Due to a limitation in the PIPDYN program, the program ignored the displacement, underestimating the nozzle loads. There is no documentation to indicate whether the verifier of the analysis noted the discrepancy and considered it insignificant to the analysis or did not realize that the program would ignore the displacement. However, standard engineering practice considers a displacement of .0015 inch as insignificant to the results in this type of analysis.

In response to this item, G/C has conducted a review (calculation P327) of all the Emergency Service Water System and the Emergency Closed Cooling Water System analyses performed on PIPDYN and found no other instances where a boundary joint represented as a spring was displaced. It should be noted that the TPIPE program, which was used for most piping analyses, does not permit this type of error.

The IDI Report also indicates, as a result of this and other deficiencies identified for piping analysis, the need to perform a reanalysis to assure that the nozzle loads acting on the ESW pumps do not exceed vendor allowables. Although this item, as discussed above, was an isolated case with no design impact, the displacement effect from thermal growth was accounted for in the reanalysis (1P45G20A, Revision 4). Based on the above, no further action on this issue is considered necessary.

D3.3-2 (Deficiency) Piping Analytical Model

Summary of Item

This item states that the analytical model used to analyze the Emergency Service Water (ESW) piping between the pump and strainer did not realistically represent the piping system during a seismic event.

Response

This item is based on the fact that the ESW pump was modeled as a rigid piece of equipment in the G/C piping analysis, rather than a flexible piece of equipment as described in the equipment vendor's stress report. The pump was modeled as a rigid piece of equipment because a review of the equipment vendor's drawings indicated that the portion of the pump which is flexible is not directly attached to the pipe. The assessment was made that the flexible portion of the pump would not significantly influence the acceleration of the piping system during a seismic event.

In response to this item, and as part of the reanalysis (1P45G20A, Revision 4) performed to assure that nozzle loads acting on ESW the pumps do not exceed code allowable stresses, the piping system was reanalyzed using the equipment vendor's flexible model of the pump. The reanalysis shows that the resulting piping stresses and pump nozzle stresses are within allowable values.

The item states that a review should be conducted to assure that other flexible equipment is properly modeled. As discussed in response to item D3.1-2, G/C has initiated a program to review other flexible equipment. Based on reviews conducted to date, it is not expected that hardware modifications will be required as a result of the reanalysis. No further action on this item is required.

D3.3-3 (Deficiency) RHR Heat Exchanger Analytical Model

Summary of Item

This item questions the technique used to predict the effects of heat exchanger thermal growth on the interconnecting piping. Only the lower portion of the heat exchangers is modeled for the tube side piping. The shell side piping is not modeled in the analysis.

Response

Two separate analyses were used to predict the effects of heat exchanger thermal growth on the interconnecting piping. As noted in the IDI Report, the heat exchanger model used in analysis 1E12G25A was used for analysis of the piping connected to the lower side of the heat exchangers. Since this piping is connected below the lower support of the heat exchangers, it is necessary to model only the lower portion in determining thermal growth effects on this piping. This is consistent with GE interface drawing 762E108, note 9, which states that "Vertical movements shall all be calculated relative to the bolted lower support elevation." Calculation 1E12G12A was used for analysis of thermal growth effects on piping, connected to the shell side nozzles. The analysis modeled the heat exchangers as rigid anchors, and the input predicted thermal growth as a displacement. This is a conservative approach. Accordingly, we believe that the techniques used to predict heat exchanger thermal growth effects on interconnecting piping were acceptable, and that the techniques were documented consistent with ANSI N45.2.11. No further analysis in response to this item is deemed necessary.

D3.3-4 (Deficiency) Nozzle Load Upset Condition

Summary of Item

The item states that thermal nozzle loads generated by the Emergency Service Water (ESW) interconnecting piping to the Residual Heat Removal (RHR) heat exchangers were not included in the upset condition analysis for this equipment.

Response

This item applies only to the axial portion of the thermal loads on two nozzles of the RHR heat exchangers. The decision to delete thermal loads from the analysis for the RHR heat exchangers was based on the unique supporting arrangement for the equipment. Thermal loads are included in upset loading condition. The analysis of the (ESW) piping connecting the RHR heat exchangers originally considered axial thermal expansion. In reviewing the nozzle loading, it was determined that the connection details for the heat exchangers had slotted holes to permit thermal expansion. As a result it was decided that the thermal axial loads would be relieved by the movement of the heat exchangers; therefore, thermal loads could be deleted from the nozzle qualification.

Axial thermal loadings generated by interconnecting ESW piping have been included in the nozzle qualifications in the reanalysis performed in response to item D3.1-4. The reanalysis indicates that nozzle loads are acceptable, although some additional analysis is being performed to confirm this. This analysis is scheduled for completion by February 15, 1985. No other analyses are deemed necessary to address this item.

D3.3-5 (Deficiency) Snubber FSAR Commitment

Summary of Item

This item states that for dynamic analysis of Class 2 and 3 piping subsystems, G/C modeled as rigid supports, contrary to the FSAR, which states that snubbers are modeled as springs.

Response

In accordance with standard industry practice, G/C models supports (including snubbers) as springs in ASME Class 1 analyses. Supports are modeled rigid in Class 2 and 3 analyses. G/C had identified the discrepancy with the FSAR concerning snubbers prior to the IDI, but the FSAR had not been revised at the time of the IDI. An amendment to the FSAR has been initiated to include a revised paragraph 3.9.3.4.1-C-1, which will state that only snubbers in Class 1 piping are modeled as springs. No further action is required in response to this item.

D3.3-6 (Deficiency) Shear Lug Qualification

Summary of Item

This item questions the design process followed for support 1P45-H515, including the assumption that loads are evenly distributed to the pipe lugs from the clamp, and the judgment to consider primary loads as primary plus secondary.

Response

As stated in the IDI Report, the original calculation evaluating lug stresses, which was performed in July 1982, assumed a symmetrical arrangement of the four lugs to calculate load on the lugs. The symmetrical arrangement was in accordance with project instructions for pipe stress analysis.

As further noted in the IDI Report during installation of the support, a field change (ECN #14061-44F-3923-A) was required, which resulted in rotation of the clamp. Although this rotation of the clamp changed the distribution of the loading, the designer judged that the lugs were still adequate because the support load was substantially reduced.

In April 1983, the pipe fabricator requested the substitution of a Western Clamp. The substitution was approved. As a result, the as-built support configuration was reviewed in May 1983, at which time the designer noted that the design load had decreased even further. Thus, the designer concluded that the support was adequate.

In response to this item, an additional calculation (pipe support Calculation 1P45-H515) has been prepared which evaluates one lug for the entire support load. This conservatively reflects the as-built configuration. The resulting stresses were determined to be within design allowables. In addition, a review will be performed by February 15, 1985, to confirm that calculation of shear lug loads is sufficiently conservative in other cases where as-built configuration differs from design assumptions.

The second issue concerns the treatment of primary loads as "primary plus secondary" loads in the shear lug calculation. By crossing out the secondary portion of the load table, the originator indicated that she recognized that there were no secondary loads on this support. The "secondary" refers to the fact that the designer was conservatively applying a local stress intensification factor of 1.5, which is required to be used only when considering secondary stresses. Since the loads resulting from this method of calculation exceeded design requirements, the designer decided to eliminate the unnecessary conservatism and to calculate stresses for a primary loading condition only. This calculation demonstrated that the design was acceptable. The use of the conservative approach in the initial calculation is the standard G/C approach, as indicated in the IDI Report.

No further action is required on this item.

D3.3-7 (Deficiency) Ball Joint Analysis Model, GAI

Summary of Item

This item states that the assumption of zero moment after breakaway for ball joints in G/C-analyzed systems is not consistent with the breakaway moment specified in the G/C Design Specification.

Response

G/C had originally performed two analyses to calculate bounding values for anchor and support loads. Based on these analyses, G/C concluded that the assumption of zero breakaway moment for the ball joint that would rotate adequately predicted resistance of the ball joint for the purpose of determining anchor and support design loads. This item states that the resultant calculated forces on adjacent anchors and supports may be underestimated.

In response to this item, G/C has performed additional analyses for each of the two G/C lines containing ball joints (Calculations 1B21G03A, Rev. 4 and 1B21G04A, Rev. 3). In these analyses, the uppermost ball joint was released as predicted by G/C's original analysis. The loadings included a moment at the released ball joint equal to the breakaway torque. Results of these analyses indicate that anchors and supports are still within code design allowables.

No further action is required in response to this item.

D3.3-8 (Deficiency) Ball Joint Analysis Model, GE

Summary of Item

This item states that the analytical model used for ball joints in GE-analyzed systems may not conservatively analyze the forces and moments on the anchor and the safety relief valve discharge nozzle.

Response

This item states that the spring rate and length used in the original analytical model "were not justified as conservative." This statement relates to GE's decision not to use a bounding load case in their analysis. GE used an analytical model of the ball joints which was selected to realistically predict ball joint rotations and forces and moments on the anchors and nozzles. The use of a realistic approach to the model rather than a bounding approach was based on a balancing of considerations relating to the prediction of rotation and support loads. It was concluded that a lower-bound spring rate would have overestimated rotation and underestimated support loads. An upperbound spring rate would overestimate support loads but underestimate rotation. Based on these factors it was decided to use a realistic value for the spring rate. The length was consistent with the overall length of the component. It was realized prior to the IDI that the length should be shortened to more properly predict ball joint action. This design change was made in 1982.

In response to this item, to confirm that the ball joints were properly modeled, GE has performed a parametric study (documented in Plant Piping Design Memo #123-8418) varying the properties of the ball joint model. This parametric study concludes that the use of a high spring rate in the ball joint model results in forces and moments on the anchors and safety relief valve discharge nozzles which are well within the allowable values. The high spring rate used in the study represented a value almost twice that of the breakaway friction of the ball joint.

All ball joints contained in GE-analyzed systems are addressed by the corrective action discussed in this response. Accordingly, no further actions are required.

D3.4-1 (Deficiency) Pipe Friction Force

Summary of Item

This item states that there was a failure to consider friction forces in the analysis of a beam supporting four Emergency Service Water pipes.

Response

This item states that, because the bending stresses due to horizontal friction forces on the beam have approximately the same magnitude as the bending stresses due to the vertical deadweight, the friction force should have been considered in the analysis. The analysis included a formal calculation of the bending stresses for the vertical deadweight force, but did not include a formal calculation for the horizontal friction force. We do not believe that a formal calculation of friction force was required in this case. Even though there were horizontal friction forces causing bending stresses approximately equal to the stresses from deadweight, the horizontal friction force is self-limiting. Therefore, it is not as significant as the vertical force to the overall ultimate capacity of the support.

Further, deadweight was only one of a number of vertical forces required to determine the total stress. The only horizontal force was due to the friction force.

In any case, the friction forces were considered by the designer, who evaluated thermal displacements of the piping and properly concluded that the friction forces were negligible. The designer was not required to document his consideration on the support design checklist. The purpose of the support design checklist (verification cover page) is to identify issues for which calculations are included in the package. An "N/A" or blank indicates that no formal calculation has been performed.

In response to this item, an additional analysis (pipe support Calculations 1P45-H061, H078, H105 and H133) was made to confirm that the friction forces would not overstress the beam. Horizontal friction forces were included in the analysis. The resulting member stresses were well within allowables and no hardware modifications were required. The additional work confirms that the designer's judgment of not including the frictional forces was valid. No further corrective action is required.

D3.4-2 (Deficiency) Snubber Support Steel

Summary of Item

This item states that the deflection of a pipe support supplementary steel beam exceeds the maximum deflection criterion stated in the pipe support design instructions.

Response

Supports 1P45-H103 and 1P45-H1C4 are a spring and snubber assembly. The spring (H103) and the snubber (H104) originally were attached to an existing W6x20 beam 54" long, which was connected to a W16x40 beam at one end and a concrete structure at the other. The support deflection was calculated and found to be less than 0.027", meeting the 0.1" deflection criterion of the support design instructions. Because of interference with electrical conduit at the concrete wall connection point, a supplementary W6x20 beam with a 9'-8" span was added 9" off the concrete wall to support the end of the original beam. This design change resulted in the 0.1" deflection criterion being exceeded.

Because of available margin in the design of the piping in question, it is not likely that exceeding the deflection criterion for the supplementary beam affects the adequacy of the design. Nonetheless, in response to this item, an Engineering Change Notice will be written by February 1, 1985, to add support under the W6 supplementary beam, which will limit the deflection to less than the established criterion.

Structural design criteria generally prescribes the use of steel beams larger and less flexible than the W6 beam used as supplementary steel in this case. We therefore believe this was an isolated case. However, a review of supplementary steel beams used as piping supports will be conducted to verify that the 0.1" deflection criterion is met. This review is scheduled to be completed by February 28, 1985.

No additional action on this item is required.

D3.4-3 (Deficiency) Design of Supplementary Steel

Summary of Item

This item states that there was an improper application of beam selection tables contained in a design standard.

Response

The originator and verifier interpreted a note in the standard regarding off-center loads on a beam to mean that only end reactions had to be checked against reactions shown on the table. Although this was incorrect, the beam subsequently was replaced with a larger beam pursuant to ECN 10714-44-7728, as noted in the IDI Report. In response to this item, 166 supports which used the design standard were identified, and the design calculations for these supports were reviewed to assure that the standard was applied correctly. Of the 166 supports reviewed, there were no other cases where the standard was misapplied in a verified design. Thus, this item is an isolated case. No further action is required.

D3.4-4 (Deficiency) Hilti Bolts

Summary of Item

This item states that there are potential inconsistencies among the design drawing, calculation, engineering change notice, and fabrication drawing concerning the type of Hilti bolts used for a pipe support.

Response

The original calculation qualifying support 1P45-H515 required the use of 1 inch diameter Hilti Kwik Bolts with a 6 inch embedment. The design drawing specified this size bolt. Hilti Kwik Bolts with a 9 inch embedment and 1-1/4 inch diameter were actually installed. Nonconformance Report (NR) PPPF-3910 was written to document the fact that the as-built condition did not match the design drawing. This NR was dispositioned "use-as-is" on the basis that the actual condition exceeded minimum design requirements.

The designer subsequently received a request from the field to relocate this support. In evaluating this change, the designer noted that 1-1/4 inch diameter bolts had been installed. This size bolt requires a minimum 6-1/2 inch embedment. As noted in the IDI Report, the new calculation used the minimum required embedment for the actural size rather than the 6-inch embedment shown on the drawing. (The use of the minimum required embedment of 6-1/2 inches rather than the actual embedment of 9 inches was conservative.) Therefore, the calculations supported the design changes and assured a properly designed support.

The IDI Report also discusses the fact that bolt hole sizes specified by Pullman Power for bolts with diameters up to and including one inch are smaller, and thus more restrictive, than G/C's specified bolt hole size. Both bolt hole sizes are acceptable, since smaller bolt hole size does not affect the capacity of the support.

In summary, our review indicates that the design calculation for the pipe support addressed in this item is correct, that the support is properly installed, and that the documentation is in accordance with procedures. Accordingly, no further analyses are required.

D3.4-7 (Deficiency) Pipe Support Calculation Check

Summary of Item

This item states that certain pipe support calculations have not been verified as required by ANSI N45.2.11 (1974), Section 4.2, "Design Analysis."

Response

This item states that the original calculations for the pipe supports summarized in Table 1 of the item do not substantiate critical design information contained on G/C drawings. We have reviewed the piping subsystem calculations and drawings covered by this item, and do not agree with the interpretations the general requirements of ANSI N45.2.11 summarized in this item of as applied to the calculations. There is no specific requirement in ANSI N45.2.11 to detail in a calculation the selection process of the items in Table 1 (e.g., clamps and struts). Most of these items are standard components with published load ratings. The approach of not expressly documenting the detailed values in calculations is consistent with industry practice.

The item implies that because the alternate calculations contain more detail than the original calculations, the original calculations were unacceptable to meet ANSI N45.2.11. The greater detail in the alternate calculations is explained by two factors. First, given the time span and the iterative nature of the pipe support design process, it is normal that the initial calculations are based on design input which is later supplemented and refined as the design proceeds over time. Accordingly, the original calculations contained less detail than the alternate calculations. In addition, the industry's interpretation of the level of detail required under ANSI N45.2.11 changed significantly between the time the original calculations and the time the alternate calculations were performed. The additional detail for the alternate calculations supplied by the verifier was consistent with the more expansive interpretation of ANSI N45.2.11.

In the case discussed in this item involving support 1P45-H511 the design verification process was successful, in that the verifier identified and corrected an error in the original calculation. As required by procedure, the verifier's calculation was also verified.

For the above reasons, no further action is required to address this item.

D3.4-8 (Deficiency) Design Control

Summary of Item

This item states that a calculation was not updated to reflect a change in the type of clamp used.

Response

During review of the design change, it was concluded that the calculation in question did not need to be revised because the load on the shear lugs was reduced by the type of clamp actually used, a Western clamp. While "stiff" clamps such as Western and E-System clamps have longer "ears" than the standard clamp, they have other features which offset the greater moment effect. The Western and E-System clamps are much stiffer and are snug with the pipe because they have pre-tensioned bolts. This rigidity reduces the "lever effect" which exists with the standard clamp. The effect on the lug is that the loads are less than with a standard clamp.

There is no specific requirement in ANSI N45.2.11, nor is it standard industry practice, to detail in a calculation a substitution of one standard component with a published load rating for another such component. Both the standard clamp and the Western clamp are standard load-rated components.

Nonetheless, in response to this item, a detailed calculation (pipe support Calculation 1P45-H511) has been performed which confirms that the pipe wall stresses at the lug are within allowable values. As noted in the IDI Report, NRC Question 210.15 addressed overall pipe stresses induced by "stiff" pipe clamps. Our response to Question 210.15 includes consideration of all pipe stresses generated by pre-tensioned "stiff" clamps.

No further action on this item is required.

D3.4-9 (Deficiency) Support Change Justification

Summary of Item

This item states that a change was made to the hardware of a support and that calculations supporting that change were not available.

Response

The change to the support member (beam) addressed by this item was made on ECN 15086-44-4451, Revision 0, dated September 1983. The originator of the ECN prepared calculations to support the change. Revision A of the ECN was written in October 1983 to add a full penetration weld. Consistent with G/C procedures, a revision to an ECN must reflect the changes made on all previous revisions and because of the short time span between Rev. 0 and Rev. A, both revisions were verified at the same time. The verifier reviewed the calculations prepared for Revision 0 and confirmed that no additional calculations were required for Revision A. The calculation was then filed with the verification of Revision A. It was not known prior to the IDI that the calculation supporting Rev. 0 of the ECN was in fact filed under Rev. A.

In response to item D3.3-7, the support configuration has been reviewed for load increases from the ball joints. Member stresses are still well within code allowables.

No further action is required.

D3.5-1 (Deficiency) Pump Qualification by Analysis

Summary of Item

This item states that an error was made in the use of the ASME Code in that a stress intensification factor was not applied to the base of the pump discharge head in the qualification of two vertical pumps.

Response

The seismic analysis of the pumps in question was performed in a vendor qualification report approved by G/C. The pump discharge head discussed in the IDI Report is a fabricated section. Subsection ND 3400 of the ASME Code requires that discontinuities be considered, but leaves the details to the discretion of the designer. As noted in the IDI Report, the vendor decided to analyze the pump discharge head as a fabricated tee using stress intensifiers specified by the ASME Code in Subsection ND 3652. For the nozzle connection, he chose an intensifier of 6.81 to account for the abrupt change of section at the interface of the two cylinders. At the base of the tee, he chose an intensifier of 1.3, which he considered sufficiently conservative to account for stresses at that point. The resulting stress at the base was very low in comparison to the allowable.

Nonetheless, in response to this item, a review (calculations 2P45G71, Rev. 2 and 1P49G50, Rev. 2) was performed using the same stress intensifier at the base as that applied to the nozzle. Although this is extremely conservative, the resulting stress was still within the allowable stress. This review confirmed that the allowable ASME Code stresses were not exceeded in the design. No further action is required.

D3.5-2 (Deficiency) Ball Joint Qualification, GE

Summary of Item

This item states that there were unresolved discrepancies between the procurement specification for the ball joints in GE-analyzed systems and the test reports used to establish qualification of the ball joints. The item also states that no test was required to justify the design use of a design value of breakaway torque which differed from the manufacturer's recommendation. Finally, the item states that the vendor-supplied operating manual does not address the frequency and type of lubrication.

Response

Main steam line C has 19 safety relief valve discharge lines attached at the safety relief valve discharge nozzles. Each of the discharge lines is anchored with about 15 feet of piping between the nozzle and the anchor. To accommodate the thermal movement of the steam line relative to these anchors and limit the reaction at the safety relief valve nozzles, three ball joints are incorporated in each of the discharge lines.

Before the purchase of ball joints for BWR-6 plants began in late 1975, GE, on its own and in cooperation with the ball joint supplier, made a number of feasibility studies, product tests and design studies. This data, test results, and studies are retained in GE Engineering and Design Record Files. The ball joint tests and feasibility studies were completed prior to issue of the purchase specification. The intent of the specification was to specify the existing data base formally. Because GE was aware that the test data met the intent of the testing requirements, those requirements were not as thoroughly stated in the specification as they might otherwise have been. In addition, a detailed comparison of the specification requirements and the test reports was not performed after the ball joints were purchased.

In response to this item, a design memo, (Plant Piping Design Memo Number 123-8418, Safety Relief Valve Ball Joint Qualification) has been written. This design memo explains the testing requirements and reconciles the design and testing requirements with the test results and design documentation submitted for the ball joints. The design memo is filed in the appropriate GE Design Record File.

The GE design memo also addresses the issue concerning the breakaway torque value.

With respect to the frequency and type of lubrication, the vendor has stated that the ball joints do not require lubrication while in service. This is the reason that no information on lubrication was included in the operating manual.

For these reasons, the ball joints have been shown to be properly qualified, and no additional analysis, testing, or hardware modifications are required as a result of this item.

U3.2-1 (Unresolved) Thermal Conditions for Design RHR-HX

Summary of Item

This item questions why the analyst did not use a 480°F inlet steam temperature when determining the temperature change for use in analysis of the piping attached to the Residual Heat Removal (RHR) heat exchangers..

Response

The originator conservatively input temperatures (including the 480°F inlet steam) to predict the thermal expansion of the heat exchangers as outlined below. The analysis of the interconnecting piping for the RHR heat exchangers reviewed during the IDI inspection is contained in Calculations 1E12G12A and 1E12G25A. Calculation 1E12G25A addressed the Emergency Service Water (ESW) cooling water lines and used a uniform temperature of 134°F. This temperature represents the maximum room ambient temperature and is higher than the maximum operating temperature of the ESW lines. Therefore, the analyst was correct in using this temperature for analysis of the ESW piping between the heat exchangers.

Calculation 1E12G12A addresses the Residual Heat Removal (RHR) piping between the heat exchangers. This analysis considers the heat exchangers as rigid and inputs boundary displacements to account for thermal growth. The analyst used 480°F for the piping and also to calculate the amount of thermal growth of the heat exchanger. He judged that the amount of differential thermal growth between the heat exchangers was insignificant and that the use of 480°F was conservative.

In response to item D3.1-4, the piping analysis has been redone (Calculation P315 and P316) and has included the complete RHR heat exchanger model and average shell temperature as specified by the GE interface drawing. This average temperature has considered both the 480°F inlet steam and the 140°F outlet water. As stated in item D3.1-4, the reanalysis has confirmed that the piping stresses and nozzle loads are acceptable without hardware modifications.

No further action is required in response to this item.

U3.4-6 (Unresolved) Dynamic Interaction

Summary of Item

. This item states that G/C pipe stress analyses do not consider dynamic interaction effects between supporting structural steel and piping during seismic events.

Response

Established G/C procedures for pipe stress analysis account for the potential influence of the structural steel on piping system frequency by either modeling pipe support stiffness or limiting pipe support deflection. Class 1 analysis procedures require that support stiffness affecting Class 1 piping be included in the analytical model. Class 2 and 3 analysis procedures generally consider supports as rigid. Support design procedures, however, require that deflection of the pipe support be limited to 0.1 inch under maximum load. Support deflection is a measure of support stiffness. (The 0.1 inch is typical of industry practice in controlling support stiffness.)

Structural steel beyond the NF pipe support boundary is not modeled in the piping analysis. Rather, the Perry floor response spectra are conservatively developed and broadened ±15% at primary and secondary peaks in accordance with Regulatory Guide 1.112. The broadening accounts for shifts in frequency due to variations in the parameters including system/structure interaction, which may contribute to variations in frequency.

Thus, we believe that the "decoupled" approach as used in the pipe stress analysis accounts for dynamic interaction between structural steel and piping. We also believe that the approach is consistent with ANSI N45.2.11 (1974). This approach follows standard industry practice and is in accordance with Regulatory Guide 1.112. The statement in Section 3.7.2.3 of the FSAR concerning the conservatism of the "decoupled" approach was an amendment to the FSAR in response to NRC Staff Question 220.01. The SER identified no problems or concerns relating to this issue.

The December 1983 newsletter referenced in the IDI Report summarizes research which raises some questions concerning the accuracy of the standard approach. However, the newsletter also states that the standard approach often produces more conservative results than the approach called for in the newsletter. We believe that further refinement of the standard approach to pipe stress analysis would, considering all relevant factors, be less conservative than the current approach.

The adequacy of the specific pipe supports cited in the IDI Report is addressed in response to item D3.4-2. No further action is required by this item.

O3.4-5 (Observation) Added Mass for Trapeze Hangers

Summary of Item

This item recommends that the weight of trapeze hanger supports be considered for inclusion in the piping analysis.

Response

A typical trapeze-type hanger usually weighs less than one foot of flooded pipe. As noted in the IDI Report, standard industry practice would not dictate including this additional mass in the analysis. This effect would contribute less than 10% additional mass to the span, and thus change the frequency less than 5%. Floor response spectra are conservatively broadened ±15% in accordance with Regulatory Guide 1.112. This broadening more than accounts for any shift in frequency due to pipe support weight and other factors not included in the analysis.

Because of the level of refinement of Class 1 piping analyses, additional mass due to pipe supports, including trapeze hangers, is included in accordance with G/C Class 1 Piping Analysis Guide No. 5. Class 2 and 3 piping analysis procedures model supports as rigid; however, G/C support designers are aware that if the support is adding significant mass to the system, they should notify the piping analyst.

In response to this item, 15 trapeze-type supports for Class 2 and 3 piping, plus the two supports identified in the IDI Report, were evaluated for effect on the piping analysis. In no case would the frequency shift have affected the analysis results. This confirms the adequacy of the G/C approach to trapeze hangers.

03.5-1 (Observation) Ball Joint Qualification, GAI

Summary of Item

The observation states that vendor test reports for ball joints did not appear to meet the requirements of the G/C fabrication specification.

Response

As indicated in the IDI Report, G/C was aware of the apparent discrepancies and was in the process of resolving the concerns with the vendor at the time of the IDI. G/C is continuing to resolve the differences between the specification and the test reports. Engineering justifications are being provided and documented to resolve the apparent discrepancies and to show that the ball joints are adequate for service conditions. No further action is required.

3.3 CIVIL/STRUCTURAL

Set forth below are our item-by-item responses to the civil/structural Deficiencies, Unresolved Items, and Observations identified in the IDI Report. The number and title of each item are taken directly from the IDI Report.

D4-1.1 (Deficiency) Boundary Stresses for Personnel Airlocks and Equipment Hatch

Summary of Item

This item states that the finite element analysis for the personnel airlocks and equipment hatch did not consider circumferential boundary forces.

Response

The IDI Report states that "circumferential boundary forces were disregarded" in the stress analysis. The analysis did consider circumferential stresses due to pressure effects, however, other circumferential boundary forces were inadvertently omitted. In response to this item, an analysis has been made to determine the effect of the other circumferential forces on stresses for both the upper and lower personnel airlocks, the equipment hatch, and the containment shell. The resulting stresses are well within those allowed by the ASME Code. The containment vessel stress report has been revised to reflect the results of the analysis.

The reanalysis performed in response to this item demonstrates that the containment vessel, including upper and lower personnel airlocks and equipment hatch, is adequate as designed. No hardware modification or additional analysis is required.

D4.2-1 (Deficiency) Failure to Document Assumption for the Reactor Building Seismic Analysis

Summary of Item

This item states that additional documentation is required to validate the use of two-dimensional modeling in the seismic analysis of the Reactor Building.

Response

This item correctly notes that an engineering decision was made that a two-dimensional, rather than a three-dimensional, analytical model adequately represents the physical characteristics of the drywell structure. The basis for the engineering decision was G/C's experience in analyzing other structures internal to nuclear power plant reactor buildings in which, like the drywell structure here, the centers of gravity are different on different floors. ANSI N45.2.11 states that procedures should include requirements for identifying those assumptions that must be verified as the design proceeds. We believe that ANSI N45.2.11 places significant discretion with the originator to decide what level of detail is required in the documentation to support the design. The originator reasonably concluded in this case that it was unnecessary to document the basis for using the two-dimensional model.

In response to the item, G/C performed calculations (Calculation Index Code [CIC]#2:01.7.2) that confirm the original engineering decision that the two-dimensional model adequately represents the structure. Specifically, G/C has calculated the mass inertia of the eccentric portions of the drywell and compared it with the symmetric torsional mass inertia of the entire structure as used in the original analysis. The comparison concludes that the eccentric mass inertia was less than 0.6% of the total symmetric rotational mass inertia and is therefore insignificant. In light of the above, no further analysis and no hardware modifications are required.

D4.2-2 (Deficiency) Failure to Update Seismic Analysis to Incorporate Structural Changes

Summary of Item

This item states that the seismic model for the Auxiliary Building is not consistent with the as-built structure. The Auxiliary Building seismic analysis is based upon a foundation mat thickness of four feet, but the final mat thickness is six feet-one inch.

Response

Seismic analyses were performed early in the design process. As the design developed, some changes in geometry, including wall and mat thicknesses, were made. Most of these changes were clearly documented in the seismic calculations, which have been revised for each building on a number of occasions. The as-built discrepancy in this case was not documented, and G/C has taken the corrective actions discussed below.

First, G/C revised the seismic model for the Auxiliary Building to reflect the base mat as-built condition noted in this item. G/C determined that the change in mat thickness and area caused only minor changes in the building frequency and structural response. G/C then went further and reviewed all Seismic Category I structures to assure that the seismic models used for the final analysis of these structures still represent the final structural response. The final construction drawings for all Seismic Category I structures have been reviewed against their corresponding seismic models. As a result of this review, seismic models are being revised for four structures - the Auxiliary Building, the Reactor Building, the Radwaste Building, and the Diesel Generator Building. Mode shapes, frequencies, and participation factors are being determined for these structures. The revised seismic model (CIC #2:01.7.3) for the Auxiliary Building has been completed and analyzed. The changes in the the frequency and structural response are well within the conservatisms of the original analysis and design. Analyses of the other three structures are scheduled to be completed by March 1, 1985.

Based upon the results to date of the review of all Seismic Category I structures, the as-built discrepancies which have been identified do not have a significant impact on the seismic analysis results used in the final design. PNPP structural design is essentially complete, and because a 100% reanalysis is being performed, no new procedure for assessing the impact of structural changes on seismic analysis is necessary at this time.

D4.2-3 (Deficiency) Omission of Mass Moment of Inertia in Seismic Analyses

Summary of Item

This item states that additional technical justification of an assumption made in the seismic analyses of the Reactor Building, Auxiliary Building, Intermediate and Fuel Handling Building, and Diesel Generator Building is required to comply with ANSI N45.2.11. The assumption is that the seismic analysis models for these structures are accurate not withstanding the exclusion of mass moments of inertia.

Response

ANSI N45.2.11 places significant discretion with the originator to decide which design assumptions require documentation. In this case the originator's prior experience with relatively rigid shear structures such as these buildings indicated that the inclusion of mass moments of inertia would have a negligible effect on the results of the analyses. In light of this, we believe that the originator made a reasonable judgment that the assumption was straightforward and did not need to be documented.

Nonetheless, to respond to this item, the seismic analysis model (CIC #2:01.7.25) for the Auxiliary Building was redone to include all rotational inertias. The new model confirms that inclusion of the mass moment of inertias has a negligible effect on both frequencies (less than 2%) and structural response (less than 0.1%). This negligible effect for the Auxiliary Building supports the judgment that the mass moment of inertia is insignificant for all Seismic Category I structures. Further confirmation will be provided by revision of the seismic models for the Reactor Building and Radwaste Building to include the mass moment of inertia. Results of these analyses will be available by March 1, 1985.

D4.2-4 (Deficiency) Calculation of Shear Area in Seismic Analysis

Summary of Item

This item states that an assumption made by a designer was not justified in the calculation. The assumption was the selection of the shear area coefficient for the seismic analysis of the Fuel Handling and Intermediate Building.

Response

The designer's decision to use a 0.5 shear area coefficient for the Fuel Handling and Intermediate Building roof slab was a decision based on G/C's experience in analyzing structures for other nuclear power plants, not an assumption that required confirmation as the design proceeds.

To respond to this item, the Fuel Handling and Intermediate Building roof slab shear stiffness was recalculated (CIC #2:01.7.6) based on the approach defined in "Mechanics of Materials" by Timoshenko and Gere. The seismic model was then rerun using this revised shear stiffness for the roof elements. A review of the resulting frequencies and structural response based on participation factors confirmed that the differences are negligible and that the original decision was reasonable.

This 0.5 shear area coefficient was not used in any other calculations for shear stiffness. Shear stiffnesses used in other seismic analyses are realistic. For these reasons, no further action is required.

D4.2-5 (Deficiency) Violation for FSAR Commitment

Summary of Item

This item states that the Golden Gate Earthquake used in the Emergency Service Water (ESW) intake and discharge tunnel seismic analysis is inconsistent with that committed to in the FSAR.

Response

The Golden Gate Earthquake was used to confirm the adequacy of the finite element model and boundary conditions and was not used for the final seismic analysis. A response spectrum (modal) analysis was used to develop the seismic loads for the final design. The response spectrum analysis is based on the Perry design ground response as defined in the FSAR. These response spectra meet Regulatory Guide 1.60. The above design approach is discussed in some detail in the following:

1. Letter dated March 11, 1982, from Dalwyn R. Davidson, Vice-President, System Engineering and Construction Group of The Cleveland Electric Illuminating Company, to Mr. A. Schwencer, Chief, Licensing Branch No. 2, Division of Licensing, NRC.

2. Letter dated June 2, 1982, from Dalwyn R. Davidson to Mr. A. Schwencer.

In the original analysis, an actual earthquake time history having a relatively short duration of strong motion with motions characteristic of that which could be expected in Chagrin shale found at the Perry site was needed to confirm the adequacy of the finite element boundary conditions. Based on these considerations, the horizontal and vertical components of the Golden Gate Earthquake record of March 22, 1957, were selected. Since the Golden Gate Earthquake was not used for developing the seismic design loads, the FSAR was not violated and need not be revised. See the response to item D4.2-6.

We agree with the IDI Report that this item is unique to the ESW intake and discharge tunnels. For all these reasons, no further action is required.

D4.2-6 (Deficiency) Seismic Analysis Based on Earthquake with Lower Peak Acceleration

Summary of Item

This item states that the Golden Gate Earthquake was used in the design of the tunnels and does not comply with the FSAR, and that the scale factor used to increase the Golden Gate vertical earthquake accelerations is too low.

Response

As discussed in the response to item D4.2-5, the seismic analysis was not inconsistent with the FSAR because the Golden Gate Earthquake was not used for design. A response spectrum analysis was used for the seismic (OBE and SSE) design loads. This is clearly stated on Page 54 of the Straam Engineers, Inc. report, "Cooling and Emergency Service Water Tunnel Design of Concrete Final Lining," dated November, 1979 (Straam Report). The response spectra comply with Regulatory Guide 1.60 and the FSAR for both OBE and SSE.

The intent of the time history analysis using the Golden Gate record was to develop an insight into the analytical interaction of the finite element model when subjected to an actual recorded earthquake. The time history analysis provides an appropriate basis for sizing the finite element model, type of radiating boundaries, and damping value. The time history analyses responses were not used as design values.

In response to the second part of the item summarized above, the 1.43 factor applied to increase the accelerations was used to assure that horizontal component meets the SSE criteria requirements for 0.15g as shown in Figure 29(a) of the Straam Report. The same factor is applied to both the horizontal and vertical component so that the original relationship of horizontal to vertical input motion of the Golden Gate Earthquake record is maintained. It is not intended that the vertical time history meet the Perry vertical spectrum requirement, as is made clear in the description on page 42 of the Straam Report. Thus the 1.43 scale factor was appropriate. No further action is required.

D4.2-7 (Deficiency) Inconsistency of Ground Response Spectra

Summary of Item

This item states that the stress analysis reports for the Emergency Service Water (ESW) tunnel have incorrect response spectra and are not consistent with the FSAR.

Response

Figures 29(a) and (b) of the Agbabian Associates Report, "Stress Analysis of the Perry Nuclear Power Plant Ten-Feet Diameter Cooling Water and Emergency Service Water Tunnels, Vol. I, June, 1975," cited in this item, compare the factored Golden Gate time history input to the SSE horizontal and vertical response spectra, respectively. In Figure 29(b) the OBE spectra were inadvertently plotted instead of the SSE spectra. As discussed in response to items D4.2-5 and D4.2-6, the time history input was not used for the final seismic analysis of the tunnels or for the final design. Thus, there was no inconsistency with the FSAR. Since the figure has not been used, and will not be used, in connection with any design or construction, the figure does not need to be revised.

We agree that this item is unique to the ESW tunnels. No further action is required.

D4.2-8 (Deficiency) Inconsistency of Damping Value Used in Diesel Generator Building Seismic Analysis

Summary of Item

This item states that documented test data is not available to justify the damping value used for the Diesel Generator Building (DGB) seismic analysis contrary to Regulatory Guide 1.61 and the FSAR.

Response

Table 1 of Regulatory Guide 1.61 relates to structural damping values. The DGB model is based on both structural and soil damping values. Because the DGB is a relatively low rigid structure founded on soil, the originator in this case correctly determined that the DGB seismic response is dominated by soil mode shapes and not by structural mode shapes. Accordingly, he relied primarily on the soil damping values in Table 3.7-1 of the FSAR. The 10% damping value for soil is used throughout the industry, and there was no requirement to support the use of this value with documented test data. We do not believe this approach was inconsistent with Regulatory Guide 1.61.

As noted in the item, FSAR Section 3.7 indicates that a damping value of 10% can be used for soil materials. Because the 10% damping value in this case represented a weighted damping for both the soil materials and structural materials, the value is consistent with the FSAR.

Nonetheless, in response to this item, a review (CIC #2:01.7.1) of the seismic calculations was performed. The review confirmed the original decision to use 10% damping since the seismic response is dominated by soil mode shapes for which 10% damping is appropriate. The review shows that radiational (geometric) damping of the soil using documented soil test data exceeds 20%, which confirms the conservatism in the original design.

We agree with the IDI Report that this item is unique to the Diesel Generator Building. No further actions are required.

D4.2-11 (Deficiency) Calculation of Lateral Soil Springs in Emergency Service Water Pumphouse Seismic Model

Summary of Item

This item states that the reference for the formulas used to calculate lateral soil springs was not included in the calculations for the Emergency Service Water Pump House (ESWPH) seismic analysis.

Response

The reference to the formula was inadvertently omitted from the calculation. However, an appropriate equation was used and the design is adequate. In response to this item, the calculations (CIC #2:01.7.16) have been revised to include the omitted reference for the soil spring calculations.

G/C personnel have been reminded by memorandum dated January 7, 1985 from the G/C Project Manager for PNPP to include references as required by procedures.

D4.3-1 (Deficiency) Inconsistency of Shield Building Drawings on Ring Girder

Summary of Item

This item states that there is an inconsistency between FSAR Layout Figures of the Shield Building showing the ring girder outline and the FSAR Structural Drawings.

Response

There was an inadvertent inconsistency in this case which has been corrected by initiating an amendment to the FSAR Layout Figures to reflect the correct Shield Building ring girder configuration. The referenced drawings were not used as input to the design. Thus the inconsistency had no impact on the design. The FSAR, the plant layout drawing, and the as-built structure will be consistent as a result of this change. We agree with the IDI Report that the deficiency is not systematic. No further corrective actions are required.

D4.4-1 (Deficiency) Use of Uncommitted Code

Summary of Item

This item states that the use of American Concrete Institute (ACI) Code 322-72 in the design of the Emergency Service Water (ESW) tunnels was inconsistent with the FSAR.

Response

The use of ACI 322-72 as a basis for design of the tunnel liner was reviewed with the NRC's Structural Engineering Branch in a meeting on February 11, 1982, and documented in formal responses to the NRC. References for the formal responses are provided in the response to item D4.2-5. G/C inadvertently failed to initiate an FSAR amendment to reflect the use of ACI 322-72. An amendment to the FSAR has been initiated to reference the use of ACI 322-72 for the ESW tunnels. Since the use of ACI 322-72 was limited to the ESW tunnels, no other action is required.

D4.5-1 (Deficiency) Voided Calculations

Summary of Item

This item states that input to calculations was taken from voided calculations in the design of the Reactor Building mat, and that this data was "potentially incorrect."

Response

The item correctly identifies several instances in which data was inadvertently used from voided calculations as design input to the Reactor Building mat design. Several revisions were made to the Reactor Building mat calculations because of changes in the design loads. The last overall revision to the calculations was made in Calculation Index Code 3:06.3-14. These calculations address all loads and load combinations; however, reference is made to design calculation values from previous sections of the calculations. In some of the cases covered by this item references were made to merely compare new results to old results and the references were not used as design input.

To address this item, a review (CIC #2:01.7.17) has been made of all references contained in Reactor Building mat calculations. While some information referenced was contained in a voided calculation and was used as a design input, all the referenced information was correct. The references have been deleted and the information has been included directly as part of the calculation. The documentation is now in accordance with standards and procedures. The deficiency has no impact on the design. Therefore, no further action is required.

D4.5-2 (Deficiency) Concrete Strength of Reactor Building Mat

Summary of Item

This item states that there is a "potential error" in the calculated concrete strength of the Reactor Building mat because it does not evaluate the middle portion of the mat.

Response

The originator made the decision that the as-built strength of the middle portion of the Reactor Building mat would be equivalent to the outer quadrants because the same concrete mix was used in both areas. We believe that this was a reasonable decision and that there was no error. Nonetheless, in response to this item, the cylinder break results for the center placement were obtained and the as-built concrete strength calculated. This strength was greater than that calculated for the rest of the mat, demonstrating that the original decision regarding the middle portion of the mat was conservative. The calculations (CIC #2:01.7.18) have been revised to include the actual strengths of the middle portion of the mat.

We concur with the IDI Report that this item is limited to the Reactor Building mat. No further action is required.

D4.6-1 (Deficiency) Steel Plate Stress Limits

Summary of Item

This item states that the actual stresses in the steel plates of the biological shield wall and Reactor Pressure Vessel (RPV) pedestal exceed the stress limits as defined in the FSAR.

Response

The criterion used for determining accident thermal stresses was consistent with the Standard Review Plan and with the ASME Code. The criterion was included in the PSAR.

Standard Review Plan 3.8.3 provides that thermal loads may be neglected where it can be shown that they are secondary and self-limiting in nature. This acceptance criterion was included in Paragraph 3.8.3.3.2.c (P-3.8.55a) in the Preliminary Safety Analysis Report (PSAR), which states:

> For cases where thermal stresses due to T_o and R_o are present and are secondary and self-limiting in nature, Equations (3) and (5) should be applied. In Equations (7), (8), and (9) thermal loads may be neglected where they are secondary and self-limiting in nature and the material is ductile.

This statement was inadvertently omitted in the FSAR.

The FSAR was clear that the ASME criterion of 3 S_m is used for secondary stresses at discontinuities. Section 3.8.3.5.2 of the FSAR states:

> The Von-Mises stresses for the biological shield wall, RPV pedestal, and the drywell vent structure were limited to 0.9 F_y for accident conditions, and to 0.6 F_y for normal operating conditions, except for regions of local discontinuities where stresses approaching the ASME criterion of 3 S_m were permitted.

Thus even though SRP 3.8.3 recognizes that secondary stresses such as thermal stresses may be neglected, G/C conservatively chose to limit accident thermal stresses to 3 S_m as permitted in ASME Code Paragraph NE-3213.9 states:

Secondary stress is a normal stress or a shear stress developed by the constraint of adjacent material or by self-constraint of the structure. The basic characteristic of a secondary stress is that it is self-limiting. Local yielding and minor distortions can satisfy the conditions which cause the stress to occur and failure from one application of the stress is not to be expected. Example of secondary stresses are:

(a) General thermal stresses [NE-3213.13(a)].
(b) Bending stress at a gross structural discontinuity.

The accident thermal stresses used in the design of the biological shield wall fit the above ASME definition of secondary stress. Thus, it was appropriate to use the higher ASME criterion of 3 S_m, which is permitted for secondary stresses.

In response to this item, an amendment to FSAR Section 3.8.3.5.2 has been initiated to clarify the criteria for plate structures by adding the PSAR statement above and the following additional sentence: "For load combinations with accident thermal included, stresses are limited to the ASME criterion of 3 S_m." In addition, the design input (DI #3:22.0)for the biological shield wall has been revised to reflect clearly this thermal stress criterion.

In conclusion, the criterion used is consistent with the SRP and the ASME Code. No further action is required.

D4.7-1 (Deficiency) Incorrect Spacing for Stirrups

Summary of Item

This item states that some of the stirrup spacings provided in Fuel Handling Building and Auxiliary Building wall design calculations exceeded the maximum spacing specified in American Concrete Institute (ACI) 318-71 Code.

Response

The item correct. notes that there were instances in which the originator inadvertent., used a spacing limit (24 inches) which was not the appropriate spacing for all cases. In response to this item, a review has been made of the stirrup spacings in the walls in all Seismic Category I structures. There were only a few additional cases identified in which stirrup spacing exceeded code allowables. Supplemental calculations (CIC #2:01.7.4) have beer ..formed of the areas in which excessive stirrup spacing occurred. The su.plemental calculations took into account conservatisms in the original design such as the use of the shear force at the support rather than at a distance "d" from the face of the support and other factors such as the as-built concrete strengths. These calculations demonstrate that stirrups are not required at all in these areas. Thus, the use of stirrups was conservative and excessive spacing of stirrups has no effect on the structural integrity of the areas. No further action is required.

D4.8-1 (Deficiency) Shear Capacity of T-Beams

Summary of Item

This item concerns a reanalysis of the Emergency Service Water (ESW) Pumphouse as-built field conditions. The item indicates that in the shear calculation for the T-beams in the reanalysis of the pumphouse walls, the shear is carried by the entire section rather than just the web, as is customary for T-beams per American Concrete Institute (ACI) 318-71.

Response

The originator of the reanalyses covered by this item correctly determined that the beams in questions were not typical T-beams as referenced by ACI 318-71 because of the relatively large ratio of the flange thickness to depth (3 feet to 5 feet). The code is applicable to flange thicknesses which are relatively thin compared to overall depth. Therefore, the use of the total area to resist the shear was judged to be appropriate by the originator. For these reasons ACI 318-71 was not applicable to the ESW Pumphouse T-beam evaluation.

Nonetheless, to respond to this item, a re-evaluation has been performed which shows the following:

1. ACI 426R, "The Shear Strength Of Reinforced Concrete Members", which presents test results for T-beams with varying flange to overall member depth ratios, demonstrates that the shear capacity of a T-beam can be based on an area which equals the area of the T-beam.

2. The shear capacity of the wall was checked as a flat slab, neglecting the web projecting from the slab. This calculation confirms that the wall is adequate to carry the shear forces.

3. As discussed in response to item D4.8-3, a finite element analysis (CIC #2:01.7.29) representing the ESW Pumphouse has been performed This analysis confirms the adequacy of the T-beams to resist the shear forces.

These conclusions all confirm the appropriateness of the original design approach and the adequacy of the design.

For these reasons, no hardware modifications to the ESW Pumphouse are required.

D4.8-2 (Deficiency) Incorrect Moment Capacity of T-Beams

Summary of Item

This item relates to the same Emergency Service Water (ESW) Pumphouse reanalysis discussed in item D4.8-1. The item states that in the flexural calculation used in the reanalysis, the wrong number of reinforcing steel bars was used.

Response

We believe the originator used the correct number of bars in the ESW Pumphouse flexural calculation consistent with the design input. The number of reinforcing bars selected as design input to the reanalysis was based on American Concrete Institute (ACI) 318-71 Code and on the construction drawings, both of which were referenced in the calculation. Therefore, the identification and control of this design input was in accordance with ANSI N45.2.11, Section 3.2.

The effective flange width per ACI 318-71 Code, Paragraph 8.7, from the center of the T-beam to the edge of the flange is 6'-8". At the worst condition, which occurs in only two T-beams, the distance to the centerline of the outermost bar is 6'-8-3/4". In every other case, the outermost bar is at 6'-6-1/4". The original decision to use four bars was reasonable and consistent with the construction drawings. However, as an additional confirmation, a finite element analysis (CIC #2:01.7.29) has been performed as discussed in the response to item D4.8-3. The analysis confirms the adequacy of the T-beams to carry the applied loads. For these reasons, no hardware modifications to the ESW pumphouse are required.

D4.8-3 (Deficiency) Negative Moment Redistribution

Summary of Item

This item relates to the same Emergency Service Water (ESW) Pumphouse reanalysis discussed in response to items D4.8-1 and D4.8-2. The item states that in the flexural calculations used in the reanalysis the redistribution of moments was not performed correctly.

Response

We agree that in this instance the originator inadvertently failed to apply properly the technique for calculating redistribution of moments.

In response to this item, a finite element analysis (CIC #2:01.7.29) was performed using NASTRAN, a widely used and accepted program. One quarter of the structure was modeled based on symmetry. The structure was also modeled for the full height including the operating floor and the roof. In the model, the wall was conservatively assumed to be fixed at the mid-depth of the foundation mat. The load combinations and loadings were unchanged from the previous reanalysis.

As part of the finite element analysis the models were initially run elastically. Where the moments exceeded the calculated section capacity, plastic hinges were introduced into the model. The model was then rerun to correctly take into account redistribution of forces as permitted by ACI 318-71 Code, Paragraph 13.3.1. The design strength at every section is greater than or equal to the required strength considering ACI 318-71 Code, Sections 9.2 and 9.3. Serviceability conditions were also addressed and found to be acceptable.

The analysis demonstrates the adequacy of the T-beams and overall structure to carry the design loads. No structural modifications are required. We agree with the IDI Report that this item applies only to the reanalysis of the T-beams for the ESW Pumphouse. Therefore, no further action is required.

D4.8-4 (Deficiency) Structural Adequacy of Roof Girder

Summary of Item

This item relates to the same Emergency Service Water (ESW) Pumphouse reanalysis discussed in response to items D4.8-1, D4.8-2 and D4.8-3. The item states that the structural adequacy of the roof steel girder and its anchor bolts were not evaluated for loads assumed in the reanalysis.

Response

We agree that the originator in this instance inadvertently made an incorrect assumption that there was a support at the bottom of the roof girder. As described in the response to item D4.8-3, a finite element analysis (CIC #2:01.7.29) has been performed in response to the IDI findings regarding this reanalysis. The finite element analysis demonstrates the adequacy of the structure to carry the design loads. Since the finite element analysis takes no credit for the roof girder as a structural support, no further analysis or modifications of the girders are required. For these reasons, no further analyses and no hardware modifications are required in response to this item.

D4.9-1 (Deficiency) Computer Program Documentation

Summary of Item

This item states that there were two deficiencies in the calculational methods included in the SLAM and MASS computer programs used to analyze the Auxiliary Building steam tunnel floor. The item also states that the beam modeling performed by G/C used improper boundary conditions.

Response

We believe that the computer programs and modeling for the Auxiliary Building steam tunnel floor and beam were correct, for the following reasons.

Computer Programs SLAM and MASS are based on finite difference theory and are used to analyze mats, slabs, and wall bending problems. The first concern stated in this item is that bending moments and shears may be underestimated at the boundaries because the program did not provide results at the boundaries.

It is correct that the program did not provide results at the boundaries, however this was not necessary because the user's manual permitted these boundary values to be obtained by extrapolation when necessary. The originators properly extrapolated the shears and moments at boundaries where required in the application of the SLAM and MASS computer programs. Nonetheless, to respond to the IDI concern, a review (CIC #2:01.7.9) was made of mats and slabs for all Category I structures. The review determined when SLAM and MASS were used, when extrapolation at boundaries was used, the method of extrapolation, and the conservatisms of the calculations. The review demonstrates that bending moments and shears were not underestimated at the boundaries in the original analyses. In each case, where extrapolation of results at boundaries was required, it was properly performed. In all cases, the reinforcement provided was determined to be adequate for the design loadings.

The next concern stated in this item is that the use of Poisson's ratio of zero in the SLAM program could be unconservative and is not in accordance with ANSI N45.2.11. Although the Poisson's ratios used in the SLAM and MASS programs were different, the programs were verified against NASTRAN, a widely used and accepted program. It was demonstrated that both Poisson's ratios, including a ratio of zero, resulted in conservative estimates of shears and moments. We believe this procedure complied with ANSI N45.2.11. No further analysis or corrective action is required.

The last concern in this item states that the end conditions on a beam in the Auxiliary Building should not have been modeled as pinned because the beam was connected to a wall. The item states that the stiffness of the walls should have been considered in modeling the beam. In this case, the originator modeled the beam as pinned in order to maximize the positive bending moments in the bottom of the beam. The originator did not have to factor in the stiffness of the wall because he made the conservative decision to design the top of the beam for the same bending moment.

For these reasons, no further analyses and no hardware modifications are required in response to this item.

D4.9-2 (Deficiency) Auxiliary Building Shear Capacity

Summary of Item

This item states that G/C structural calculations determined shear reinforcement requirements in a beam in the Auxiliary Building without consideration of the concurrent axial force as required by American Concrete Institute (ACI) 318-71 Code.

Response

Although the originator had not considered the concurrent axial tension force in the beam, alternate calculations performed as part of the verification included the concurrent axial force. These alternate calculations confirmed the adequacy of the reinforcement provided by the originator. Thus the calculation as verified met the ACI Code. The IDI Report also concluded that there was no impact on design.

We agree with the IDI Report that there was no impact on design, and that other design calculations have properly accounted for the axial tensile forces effect upon the shear strength of concrete. No further action is required.

D4.9-3 (Deficiency) Design Verification

Summary of Item

This item states that the verifier's alternate calculation, which was discussed in the previous item D4.9-2, should have been verified because it was based on different loads and resulted in different reinforcing steel.

Response

We believe the alternate calculation met G/C procedures. Section 3:25 of the Perry Procedures Manual, referenced in this item, incorporates by reference G/C Design Control Procedure (DCP) 2.05, "Design Verification." DCP 2:05 requires the verifier to assure that the results of the alternate calculation are consistent with the results of the original calculations. In this case the reinforcing steel provided by the originator was adequate to meet the reinforcement requirements calculated by the verifier. Thus, the results of the original and alternate calculations were consistent, and no verification of the alternate calculation was required. Consistent with DCP 2:05, both the original and alternate calculations were retained as part of the permanent design documentation. Nonetheless, in response to this item, the alternate calculation (CIC #2:07.2) was verified and the adequacy of the design again confirmed. No further action is required.

D4.9-4 (Deficiency) Axial Tensile Forces

Summary of Item

This item states that in the G/C calculations for the Auxiliary Building steam tunnel floor, the omission of tensile forces in determining the required flexural and shear reinforcement in the design of the beam was contrary to American Concrete Institute (ACI) 318-71 Code and unconservative.

Response

The decision to omit tensile forces in the beam flexural and shear calculations was appropriate in this case to take account of the shear walls at the ends of the beam, and was consistent with ACI 318-71 and sound engineering practice.

This item is based on the alternate calculations for the Auxiliary Building steam tunnel floor. The design documentation includes both the originator's calculations and the verifier's alternate calculations. The verifier's alternate calculations included a statement that tensile forces were assumed to be carried by the shear walls on both sides of the beam, not by the slabs as stated in the item. This assumption was consistent with elastic theory, since the stiffness of the walls are significantly greater that the stiffness of the beam, and the wall stiffness would eliminate tensile forces in the beam. Thus, the flexural and shear calculations were consistent with ACI 318-71 because tensile forces were adequately considered. No further action is required.

D4.9-5 (Deficiency) Auxiliary Building Counterforts Lap Splice of Dowel and Mat Bars

Summary of Item

This item states that there was a failure to include a lap splice between the reinforcing steel extending into the Auxiliary Building counterfort and the bottom reinforcing steel in the mat contrary to American Concrete Institute (ACI) 318-71 Code.

Response

The reinforcing steel detail covered by this item was not designed to be a lap splice. ACI 318-71 requires that the reinforcing steel be adequate to resist the applied loads, but does not specify locations which require lap splices. Drawings D-412-043 and D-412-050 show the details for the counterfort and wall reinforcement and mat reinforcement. As detailed and constructed, the counterfort and wall reinforcement were extended to within three-inches clear of the bottom of the mat. This provided a length in excess of a full development length into the foundation mat. The bottom mat reinforcement was extended to within three-inches clear of the side of the mat and provided with a standard hook. This detail was developed consistent with ACI 318-71 requirements. Nonetheless, in response to this item, calculations (CIC #2:01.7.23) have been made to confirm that the reinforcing details at the bottom corner of the mat are adequate to resist the applied forces. These calculations demonstrate the adequacy of the existing reinforcing details to resist the applied loads. No further action is required.

D4.9-6 (Deficiency) Critical Section for Shear

Summary of Item

This item states that Auxiliary Building calculations for deep beams contained incorrect locations of the critical section for shear, and as a result, the amount of shear reinforcing may be underestimated.

Response

Some of the Auxiliary Building calculations identified in this item failed to apply deep beam theory and as a result contained incorrect locations of the critical section for shear. To address this issue we reviewed these and other Auxiliary Building calculations. These reviews (CIC #2:01.7.14) demonstrate that, in the five cases referenced in this item, the design still contains adequate reinforcing steel.

A summary of our review of the calculations identified in this item is provided below.

(1) Calculation 4:07.2-28

This application involved a concrete beam that is an integral part of a floor slab system. It would have been more conservative to have applied ACI 318-71 deep beam theory in this case, despite the fact that the beam is only partially loaded from its top or compression element (see ACI Commentary to Section 11.8.1). The review of this calculation compared the nominal shear stress that can be carried by the concrete, and the ultimate shear stress determined at the critical section, and determined that the capacity of the concrete to resist the shear stresses was at least twice the ultimate shear stress. Thus, it was confirmed that no shear reinforcing was required.

(2) Calculation 4:05.2-335

This application concerns counterforts in exterior walls. The design of the counterforts is unique to two walls of the Auxiliary Building. Because each of these beams has its load applied on its lower face or tension element, it was not designed as a deep beam. Accordingly, ACI 318-71 deep beam theory does not apply (see ACI 318-71 Commentary on Section 11.8.1). This design approach to the counterforts is noted on page 4:05.2-341 of the calculation.

(3) Calculation 4:04.6-28

In this application, a slab was used as a horizontal beam for lateral loads at an opening. As part of the review of this calculation, in response to this item, the ultimate shear stress was calculated at the critical section using ACI 318-71 deep beam theory. It was determined that no shear reinforcing was required. This confirmed the conservatism used in the original design.

(4) Calculation 4:04.6-29

This application concerns a concrete beam at the edge of an opening with vertical loads. In response to this item, the review of the calculation compared the ultimate shear stress at the critical section to the nominal shear stress that can be carried by the concrete, and determined that shear reinforcing was not required under ACI 318-71. Thus, the review confirmed the conservatism used in the original design.

(5) Calculation 4:05.4-35

This application concerns walls acting as beams above openings. In response to this item, the calculation was checked using deep beam theory, and the reinforcement provided by the original design was confirmed to be conservative.

In addition to the review of the five calculations identified in the IDI Report, a comprehensive review of the drawings and calculations for the Auxiliary Building was performed to determine whether the deep beam provisions of ACI 318-71 were applied where appropriate. In most but not all cases, deep beam theory was used where appropriate. For those few cases where beams were not identified as deep beams in the original design, the beams were reviewed applying ACI 318-71 beam theory. In each instance, the beam was found to be adequately reinforced.

In light of the above, the Auxiliary Building design meets ACI 318-71 deep beam requirements and contains adequate reinforcing steel for deep beams. No further action is required.

D4.10-1 (Deficiency) Inconsistencies Among Design Documents, Construction Drawings, and Reinforcing Steel Lists

Summary of Item

This item identifies inconsistencies among the design documents, the construction drawings, and the reinforcing steel lists for the Diesel Generator Building.

Response

This item correctly identifies a number of inconsistencies. We have thoroughly reviewed the areas covered by this item. Our reviews demonstrate that the inconsistencies are minor in nature and do not affect the design.

The specific inconsistencies identified have been evaluated and corrected as follows:

1. Calculation 10.05.2, page 60, showed the shear reinforcement to be #6 bars at six inches, but the construction drawing D-417-086A in section 1B-1B indicated the bars were to be spaced twelve inches apart.

   The correct spacing for the #6 bars, which is shown in Elevation 1-1 on drawing D-417-086A, is six inches. Also, the number of bars provided on the steel list agrees with the six-inch spacing.

   Section 1B-1B of drawing D-417-086A is in error and has been corrected by ECN 24728-19-263, Rev. A.

2. The design calculations showed that stirrups should be #6 bars at six inches, but the construction drawing D-417-588C in sections 5D-5D, 5E-5E, and 5F-5F indicated that #5 bars at six inches were to be used.

   A review was made to determine why drawing D-417-588C reflected a reinforcement different from the design sketch. It was found that the designer, working closely with the drafting group, had approved the change from #6 to #5 bars by marking up the drafting group's copy of the design sketch and initialing and dating it. In addition, the calculation originator reviewed and approved the construction drawing indicating his agreement with the as-issued details. The calculations (CIC #2:01.7.20) have been revised to reflect the use of #5 bars. This reinforcement meets the design requirements.

3. Drawing D-417-588C showed #6 bars, while the reinforcing steel list called for #5 bars.

Based on the steel list, #5 bars were fabricated and installed. Supplemental calculations (CIC #2:01.7.20) have been made which demonstrate that the area of steel provided by the #5 bars is greater than the area of steel required. The drawing has been revised to show the #5 bars by ECN 24728-19-263, Rev. A.

4. Elevation 1-1 on drawing D-417-125 shows #6 bars at twelve-inch spacing, while section 1A-1A on the same drawing shows #4 bars at twelve-inch spacing.

   The reinforcement steel list confirms that #6 bars were provided and installed. Section 1A-1A of drawing D-417-125 has been revised to reflect the #6 bars which were used by ECN 24728-19-263, Rev. A.

To address the concern stated in the IDI Report with respect to consistency between the as-built drawings and design requirement for the Diesel Generator Building, a comprehensive review (CIC #2:01.7.26) was performed of the design sketches in the Diesel Generator Building against the construction drawings. No additional differences were found between the design sketches and drawings regarding the size and spacing of stirrups. The review also found in a few cases more flexural reinforcement was provided than shown on the design sketches, (i.e., the final design was conservative). In several other cases, less flexural reinforcement was provided than was shown on the design sketch. However, in these cases the reinforcement provided still exceeded the calculated reinforcement requirements. Where appropriate, original design sketches have been revised to reflect the reinforcement on the construction drawings where appropriate.

Our review of the calculations demonstrates that the originator was conservative in the original design sketches for reinforcement. In every case, reinforcement on the construction drawings provided meets the design requirements. In light of the above, no further analyses and no hardware modifications are required in response to this item.

D4.10-2 (Deficiency) Discrepancy Between Design Documents and Construction

Summary of Item

This item states that the horizontal shear reinforcement was not properly transferred to drawing D-417-125 from the Diesel Generator Building calculation.

Response

We believe the construction drawing does provide horizontal shear reinforcement consistent with the design calculation. The originator's calculation for concrete horizontal shear stress and capacity determined that only minimum shear steel was required (page 10:05.3-16). Minimum steel vertically is #8 bars at twelve inches and horizontally is #6 bars at twelve inches (ACI 318-71 Section 11:9.6). Construction drawing D-417-125, Elevation 1-1 and Section 1A-1A show the following steel:

#9 bars at twelve inches horizontally in each face throughout the depth

#9 bars at twelve inches vertically
#6 U-bars at twelve inches top and bottom throughout the length

The #9 bars were selected to be consistent with the reinforcement in the adjacent sections of the wall. Thus, the steel provided is more than the minimum, and is more than adequate to meet the design requirements.

In response to item D4.9-6, the design of deep beams for all Seismic Category I structures was reviewed to assure that shear reinforcement was provided as designed and as required by ACI 318-71. In every case the reinforcement was provided as designed and required.

For these reasons, no further analysis and no hardware modifications are required to respond to this item.

D4.10-4 (Deficiency) Diesel Generator Building Wall Design Loads

Summary of Item

This item states that an assumption in the Diesel Generator Building wall design Calculation 10:05.3, that the loads from the E-W walls are carried to the wall below through the perpendicular crosswall, was not documented in accordance with ANSI N45.2.11.

Response

The originator's decision that the loads from the E-W walls are carried to the wall below through the perpendicular crosswall was sound, and we do not believe ANSI N45.2.11 required a calculation to support this assumption. The originator's decision was based on the depth of the supporting wall (18'-6"), the amount of reinforcement in the wall (#8 bars at twelve inches each face), and the cantilever span (3'-0"). It was evident without a calculation that a wall with these relative parameters was adequate to resist the applied loads.

Nonetheless, in response to this item, calculations (CIC #2:01.7.21) have been performed which demonstrate the adequacy of the cantilevered portion of the E-W wall to transfer the required loads. The original calculations have been revised to include this additional documentation and no further action is required.

D4.10-5 (Deficiency) Use of ACI 318-63 Instead of ACI 318-71

Summary of Item

This item states that an earlier version of American Concrete Institute (ACI) 318 (1963 edition) rather than the version of the ACI Code (1971 edition) referenced in the FSAR was used to design a concrete slab in the Diesel Generator Building and that the resulting design may be unconservative.

Response

We believe the originator's application of the ACI 318 Code was appropriate and consistent with the FSAR. In the Diesel Generator Building roof slab design, the originator used an ACI 318-63 Code empirical method to determine the moments in the slab. The slab was then designed for the moments in accordance with ACI 318-71. Although ACI 318-71 Code defines a new direct design method to determine the moments, the ACI 318-71 Code Commentary in Section 13.3 states, "Methodologically, the direct design method compares with the empirical method for flat slabs included in preceeding editions of the ACI 318 Code." Based on this Commentary, the designer properly applied the ACI 318-63 empirical method to calculate the moments used in the design.

Nonetheless, in response to this item, the slab has been evaluated (CIC #2:01.7.22) using the ACI 318-71 Code direct design method. This evaluation confirms the original design. The calculations have been revised to include this evaluation, and no further action is required.

D4.11-1 (Deficiency) Anchor Bolt Preload Control

Summary of Item

This item states that G/C's use of A354 anchor bolts for Emergency Service Water (ESW) pumps was inconsistent with the pump manufacturer's specification. The item also states that engineering approved bolt torque values applied in the field were inconsistent with G/C drawings, and could violate G/C guidelines for prevention of stress corrosion cracking of high strength anchor bolts.

Response

As explained below, we believe that G/C's use of A354 anchor bolts was appropriate and conservative. We also believe that the torque values questioned in this item are acceptable.

The use of A354 Grade BC anchor bolts in lieu of the manufacturer specified A325 anchor bolts is conservative. For the 1 1/2-inch diameter A354 bolts used, the minimum specified yield strength is 109 ksi and the minimum specified tensile strength is 125 ksi. For the A325 bolts, the comparable values are 81 and 105 ksi, respectively. Because the bolts provided are stronger than those specified, they are satisfactory without any documentation from the vendor.

With regard to the torquing issue, the G/C structural drawing (D-426-308) indicates in Note 5 that: "Unless otherwise noted, nuts on anchor bolts shall be installed snug tight." There is no structural restriction for torquing anchor bolts except that they not be over-torqued. The torquing limit is the responsibility of the group specifying the torque values. The contractor was provided general guidance to install the nuts snug tight unless some other requirement, such as a vendor requirement, requires them to be torqued. The main concern expressed in the G/C guidelines with respect to stress corrosion cracking was exposure to borated water, rather than any concern for torquing.

In this case, several documents indicated that torquing was required. ECN 3127-44-122, which was issued by the G/C Mechanical Engineering group, provided torque values for A307 bolts. Field Question 18992 was written by the contractor to ask for clarification of the torquing requirements for the ESW pump anchor bolts, since the ECN did not provide values for those bolts. The contractor was instructed by Mechanical Engineering to use the same torque values as the A307 bolts. G/C Structural Engineering acceptance of the specified torque values was documented on the Field Question by the Lead Site Structural Engineer.

The torque values specified by ECN 3127-44-122 are acceptable to G/C Structural Engineering for both A307 and high strength A354 bolts. This application of A354 bolts does not violate any guidelines of the G/C Structural Engineering Design Guide DG-SE-10 related to stress corrosion cracking or otherwise. Because there is no systematic problem with torquing of anchor bolts, no additional documentation or further action is required.

D4.11-2 (Deficiency) Seismic Pump Reactions

Summary of Item

This item states that the effects of the horizontal loads transmitted to the Emergency Service Water (ESW) Pumphouse interior wall from the ESW pump supports were not evaluated for load combinations included in FSAR Table 3.8-6 and G/C design criteria.

Response

In this case, an engineering decision was made that the horizontal seismic loads transmitted from the pump supports were negligible. We believe this decision was appropriate, and that horizontal loads were properly considered, as required by the FSAR and G/C design criteria.

The originator's decision was based on the magnitude of the support reactions and the wall geometry (5-feet thick). The original design of the wall [illegible]re the lateral seismic supports are anchored was based on full hydrostatic pressure (with one cell filled to maximum water level and the adjacent cell empty), combined with sloshing and transverse seismic load due to the weight of the wall. Functionally, once the plant is in operation, there will always be water in both cells of the pumphouse. In view of the conservatism in the design approach and the relatively light loads from the seismic supports, the wall was judged adequate for the pump support loads without further calculations.

Nonetheless, to respond to this item, a supplemental calculation (CIC #2:01.7.15) was performed which included the combined effects of the load combinations included in Table 3.8-6 of the FSAR and the G/C design criteria, i.e., support loads, the predicted water levels in the cells, sloshing, and transverse seismic loads. This analysis confirmed the original engineering decision that the design is adequate for all loads and load combinations including pump support reactions.

For these reasons, no further analyses and no hardware modifications are required.

D4.11-3 (Deficiency) RHR Heat Exchanger Supports

Summary of Item

This item states that a General Electric (GE) table specifying loads on the supports for the RHR heat exchanger omitted concurrent loads and also failed to indicate whether orthogonal seismic effects were included in the maximum loads contained in the table. The item also states that in one case the originator of the RHR heat exchanger support steel incorrectly interpreted illegible load values contained on a copy of an ECN written for the heat exchangers.

Response

With respect to the GE table, we agree that concurrent loads should have been included in the table, since the maximum reaction at each support was not used concurrently. Orthogonal seismic effects were included in the table's maximum loads. There are no requirements that this fact be expressly stated in the GE table.

In response to this item, GE has confirmed that the calculation of the maximum single load and the total load did take into account orthogonal effects in accordance with Regulatory Guide 1.92. A calculation (CIC #:01.7.19) will be completed to confirm that supporting structural steel is adequate for the revised loads. This calculation will be completed by March 1, 1985. Based on current available loads, we expect the calculation to demonstrate that the supporting structural steel is adequate.

In addition, GE loading tables for other equipment supported on structural steel will be reviewed. The results of this review will be used in revised calculations (CIC #2:01.7.19) of loads on the supporting structural steel. It is expected that loads on supporting steel, for other equipment, will not be significantly affected by these revised calculations. These calculations will be completed by March 1, 1985.

With respect to the issue concerning illegible load values, the originator did not correctly interpret the illegible load values in question. However, the originator's approximation of the loads was conservative. In response to this item, the copy of the ECN in the calculation has been voided, and a reference added in the calculation to the GE drawing containing the load value. We agree with the IDI Report that this was an isolated case.

D4.11-4 (Deficiency) Capacity of Nelson Stud Group

Summary of Item

This item states that a calculation error was made in determining the load capacity of a group of Nelson studs attached to an embedded plate.

Response

This item correctly notes that an error was made in the calculations for an embedded plate. The originator used a unique approach in the design of the referenced embedment, in that he used stresses rather than forces to determine the capacity of the studs. Unlike the usual approach, this approach required use of the tensile area of the stud. The originator inadvertently included the tensile area twice.

In response to this item, a review (CIC #2:01.7.24) was made to assure that any other similar embedded plate calculations performed by this originator were acceptable. The review confirmed that this originator had not performed any embedded plate designs other than the two included in the calculation reviewed during the IDI. We concur that this error had no effect on the required number of studs.

In light of the above findings, no further action is deemed necessary.

D4.11-5 (Deficiency) Heat Exchanger Supports
Superceded Calculations

Summary of Item

This item states that in the RHR heat exchanger support Calculation 4:09.2, there were some voided sheets in the calculation which were not marked void.

Response

Our review of this item indicates that the voiding of this calculation was accomplished in accordance with applicable G/C design control procedures.

At the time of this calculation, neither ANSI N45.2.11 nor G/C's procedures required each page of a superceded calculation to be marked void. The original calculations were clearly marked superceded on the cover sheet (Verification Record) which was considered sufficient under G/C's procedures. Subsequent to this calculation and prior to the IDI, G/C amended its procedures to require that voided pages be individually marked. The procedure applied to subsequent calculations, and did not require G/C to update earlier calculations such as Calculation 4:09.2. Pages 33-41 of the calculations had been voided by the originator in the process of performing the calculation, and did not represent a limited voiding of the calculation. However, in response to this item and consistent with G/C's current program requirements, each page of the calculation has been marked void. No further action is required.

D4.12-1 (Deficiency) Equivalent Static Load

Summary of Item

This item states that G/C's equivalent static load approach for tray, duct and conduit support design used a factor of 1.0 on peak accelerations, without justification, contrary to the FSAR.

Response

The G/C structural supports group responsible for the PNPP design had performed calculations for another nuclear plant which supported the use of a 1.0 factor at PNPP.

Although the FSAR provision cited in this item did not apply to tray, duct, and conduit, and was not violated, we do agree that the originator in this case should have provided additional technical justification for the use of a factor of 1.0 on peak acceleration.

In response to this item, confirmatory calculations (CIC #2:01.7.12) have been made which support the original design decision. A typical structural support with typical masses (system loads) was analyzed using both an equivalent static load method and dynamic analysis. The static model was analyzed using the 1.0 factor on peak floor response acceleration "g loads." The dynamic model was analyzed using a floor response with the same peak acceleration level as that used in the static analysis. The results were compared to show that the equivalent static load method using the 1.0 factor gave acceptable results.

Several significant conservatisms were included in the model and the analysis used to respond to this item to demonstrate that the results of the comparison would be valid for all supports:

1. The model had lumped masses at several points along the member length representing the support of systems at various elevations.

2. The dynamic input was a floor response spectra with all frequencies having an acceleration equal to the peak floor response spectrum acceleration used in the static analysis for design. This very conservative dynamic input guaranteed that all modes would have maximum possible contribution.

3. More than the usual number of higher modes were included in the analysis.

Even with these conservatisms in the dynamic analysis, support members and connections designed by the static analysis were equal to or stronger than members required by dynamic analysis. This confirmed that the use of the 1.0 factor provides a conservative design.

The 1.5 factor in FSAR Section 3.7.3.5 deals with the equivalent static load approach for equipment, and does not address tray, duct, and conduit supports. An amendment to FSAR Section 3.7.3.5 has been initiated which clarifies that a 1.0 factor is being used for tray, duct and conduit support design.

No further analyses and no hardware modifications are required in response to this item.

D4.12-2 (Deficiency) Conduit Supports

Summary of Item

This item states that there was inadequate technical basis documented in the design to support the G/C criterion for conduit design for jet impingement pressures normal to the wall.

Response

We do not agree that additional calculations are required to confirm the engineering decision made by the originator. The G/C criterion was based on an engineering decision that jet loads on conduit are self-limiting and will not adversely affect the structural performance when the jets are directed toward the wall and the conduit deflection is limited to 3/4" to 1". We do not believe ANSI N45.2.11 required that this engineering decision be supported with calculations.

Nonetheless, in response to this item, confirmatory calculations (CIC #2:01.7.5) have been performed based on bending tests of conduit performed at the Perry site prior to the IDI. All sizes of conduits had been tested. The tests consisted of simple spans of conduit loaded at the center by concentrated loads. Deflection to span ratios were obtained from these tests to establish the acceptance criteria for judging the capability of conduit to safely deflect the 1" distance. All possible conduit spans were examined using these criteria, showing that for any span the conduit will adequately perform its intended function of protecting the electrical cable from the applied jets and concurrent earthquake loading. These calculations have confirmed the adequacy of the original conduit design. No further action is required.

D4.12-3 (Deficiency) Conduit Supports

Summary of Item

This item states that a consistent approach was not used for determining the allowable bending stress in the design of angle supports for electrical conduit, that calculations were unclear on the allowable stress to be used with the load combinations included in the FSAR.

Response

We agree that a consistent approach was not used for determining the allowable bending stress, but do not believe this violated procedures or affected the design. We do not agree that calculations are unclear on the allowable stresses used in evaluating the load combinations from the FSAR.

We performed a detailed review (CIC 2:01.7.8) of angle support calculations and found that 100% of the computer designed angle supports, and over half of the manually-designed angle supports used the same approach for determining the allowable bending stress. In these cases, the allowable bending stress was determined by applying a reduction factor of 0.75 to the normal allowable stress to account for increased bending stresses in angle supports. The 0.75 factor is a generally conservative reduction, since factors for various angles and bending moments would result in factors ranging from 0.73 to 0.83.

For the remainder of the manually-designed angle supports, the allowable bending stress was determined by applying either no reduction factor or a 0.83 factor to the normal allowable stress. To further evaluate calculations using either no factor or 0.83 factor, a group of manually designed angle supports were evaluated in greater detail. All angle supports were found to have sufficient conservatism to be fully acceptable. Conservatisms were of the following nature:

1. Use of allowable stresses lower than allowed by AISC.

2. Selection of members giving calculated stresses below AISC allowables.

3. Use of minimum orthogonal section modulus regardless of direction of bending force even though the maximum section modulus would be correct for at least one direction bending moment.

4. Use of peak of floor response curve to obtain loading accelerations.

5. Absolute addition of stresses from accelerations in three orthogonal directions.

6. Use of highest vertical accelerations and highest horizontal accelerations from all load combinations to form a conservative load combination.

Finally, in response to this first concern, Criterion #25 of 36.01.1, "Loading Combinations and Acceptance Criteria," has been revised to define appropriate and consistent methods for accounting for increased bending stresses due to unsymmetrical section properties. This change in the criteria will eliminate inconsistencies in the future.

With respect to the second concern, the allowable stress to be used with various load combinations is clearly defined in Criterion #25 of CIC #36.01.1. In the three calculations referenced in this item, the evaluation of extreme/accident load combinations was made by reducing these loads to equivalent normal/severe loads and comparing the reduced loads with the normal/severe load allowable stresses described below.

Calculation	Allowable Stress (ksi)	Reduction Factor for Unsymmetrical Bending
36:36102.8	16.2	0.75
36:36202.18	18	0.83
36:32204.12	21.6	1.0

The 27 ksi mentioned in the description of the item in the IDI Report for calculation 36:36102.8 is actually the first step in a two step process of determining the allowable stress. The first step is : 0.75 x 36ksi = 27ksi. The second step is: 0.60 x 27ksi = 16.2ksi. This two step process resulted in allowables which were consistent with FSAR allowables.

For these reasons, we believe the load combinations and allowable stresses used in the referenced calculations are consistent with the FSAR.

In light of the above, no further analyses and no hardware modifications are required in response to this item.

D4.12-4 (Deficiency) Factor of Safety for Hilti Bolts

Summary of Item

This item states that the factor of safety used for Hilti Bolts under LOCA loads is not consistent with G/C Structural Criterion No. 10.

Response

We believe that the factor of safety used for Hilti Bolts under LOCA loads is consistent with the G/C Structural Criterion No. 10. Criterion #10 (File Code 1:02.2) applies to the use of Hilti Bolts for structures throughout the plant. The commentary to Criterion #10 requires a minimum factor of safety of 4.0 for LOCA loads. A minimum factor of safety of 4.0 is consistent with the NRC's IE Bulletin 79-02. Nonetheless, in response to this item, the main text of the criteria has been revised to explicitly address the factor of safety of 4.0 for LOCA loads.

Since the criterion was applied correctly for LOCA loads, G/C Calculation 36:72.16.1, page 12, is correct and does not need revision. In addition, other calculations need not be reviewed since a minimum factor of safety of 4.0 was used. No further analysis and no hardware modifications are required in response to this item.

D4.12-5 (Deficiency) Hilti Bolt Spacing

Summary of Item

This item states that the calculation for closely spaced Hilti Bolts used "projected cone areas" as provided by American Concrete Institute (ACI) 349-80 Code rather than "cone areas" as required by G/C Structural Criterion #10.

Response

The calculation for closely spaced Hilti bolts did use the "projected cone areas"; however, this approach was appropriate in this instance. The originator of the criteria in this case inadvertently omitted the word "projected" from the criteria, although it was clear to those using the criterion that the intent was to use the ACI 349-80 Code requirement of "projected cone areas." In this case, the correct ACI criterion was used.

Further, it makes no difference for this or other calculations using the criteria whether "cone areas" or "projected cone areas" are used, since the factor calculated is a ratio of partial cone area to total cone area, which is the same as the ratio of the projected partial cone area to the projected total cone area.

In response to this item, Criterion No. 10 has been revised to state "projected" cone area in agreement with the ACI 349-80 Code and the calculations.

In light of the above, the calculations need not be revised. No further analysis or hardware modifications are required.

U4.2-9 (Unresolved) Discrepancy in Seismic Models

Summary of Item

This item requires confirmation that the surcharge (structural interaction) effects in the N-S Slice Model for the Diesel Generator Building seismic analysis have been adequately addressed. The item also states that G/C should determine whether this issue is applicable to the Radwaste and Off-Gas Buildings.

Response

Structural design forces and floor response spectra initially were developed in both the N-S and E-W directions based on a lumped mass model for the structure and finite element representation of the soil. Interaction due to coupling of adjacent structures through the soil was considered to be negligible. To confirm that this interaction was minimal (prior to the IDI) finite element models were constructed for the N-S and E-W directions which included the coupling effect of the adjacent structures. This model was then analyzed for the E-W direction. The results of this analysis confirmed the adequacy of the design accelerations and floor response spectra obtained from the lumped mass model. A decision was made that the N-S model did not need to be analyzed.

In response to this item, the N-S model (CIC #2:01.7.11) was also analyzed. The analysis confirmed the original decision that the design accelerations and floor response spectra obtained from the lumped mass model are adequate.

With regard to the second item, the Radwaste Building is founded on fill concrete; therefore, interaction effects need not be considered. FSAR Section 3.7.1.4 states that the Radwaste Building is founded on lower till. Construction drawings D-744-182 and D-744-183 show the Radwaste Building is founded on fill concrete. An FSAR amendment has been initiated to state that the Radwaste Building is founded on fill concrete. The Off-Gas Building is founded on upper till; therefore, a finite element analysis was used and interaction effects considered in the original analysis. No additional analyses and no hardware modifications are required.

U4.10-3 (Unresolved) Assumption Made Without Documentation in Designing Slabs with Trench

Summary of Item

This item requests confirmation that the worst case slab sections (trenches) for flexural design and shear capacity were chosen in the slab analysis and design of the Diesel Generator Building.

Response

The choice of trenches and their locations are indicated in the calculation on page 10:04.2-22, and the calculations for maximum moments and shear are provided on page 10:04.2-28. Nonetheless, in response to this item, a review of the calculations has been performed to confirm that the trenches evaluated were the worst case sections. These trenches were selected at locations of maximum positive and negative moments meeting the requirements of ACI 318-71 Code, Paragraph 8.4. No further action is required.

04.2-10 (Observation) Wrong Earthquakes - Reactor Building Seismic Analysis

Summary of Item

This item recommends that superceded ground response spectra curves found in the Reactor Building seismic calculations be voided and replaced with the Regulatory Guide 1.60 spectra curves which were actually used in the plant seismic design.

Response

We agree with the recommendation of the IDI Report that the superceded ground response spectra curves be voided (CIC #2:01.7.13). Accordingly, the response spectra curves have been voided. It was not necessary to replace the voided curves with the correct Regulatory Guide 1.60 curves since a time history approach was used and the ground response spectra were not directly used in the analysis. No further action is required.

04.2-12 (Observation) Response Spectrum Curve Inconsistent with Regulatory Guide 1.60

Summary of Item

This item states that Figures 9(a) and 9(b) in the Straam Engineers, Inc. report, and Figure 5 of the Agbabian Report, referenced in this item, contain seismic response spectra curves for 0.5% damping which do not agree with FSAR Figures 3.7-1 and 3.7-2, and Regulatory Guide 1.60.

Response

As noted in the IDI Report, 0.5% damping curves were not used in the design. Rather, the 5% damping curves shown in the FSAR, which comply with Regulatory Guide 1.60, were used. Because this inconsistency does not affect the design in any way, we do not believe it is necessary to revise the curves contained in the tunnel analysis reports.

04.7-2 (Observation) Load Factor for Dead Load

Summary of Item

This item states that load combinations as documented in the FSAR use a minimum load factor of 1.2 for dead load rather than the 0.9 factor recommended by Regulatory Guide 1.142 and ACI 349-76. The item recommends that the effect of using a coefficient of 0.9 be evaluated for all concrete structures.

Response

As discussed in the IDI Report, the response to action Item 40 of the NRC Structural Engineering Branch Audit of December 1, 1981 through December 4, 1981, addressed this same issue for the design of the drywell wall, the Reactor Building basemat, and the roof of the Auxiliary Building. The roof of the Fuel Handling Building also was addressed in this response. As stated in the IDI Report, the response shows that these structures are adequate.

In response to this item, we are evaluating the effect of using a 0.9 dead load factor for other structures. In addition to the structures specifically cited in the IDI Report (walls in the Fuel Handling Building and the Emergency Service Water Pumphouse), walls subjected to soil pressures in the Radwaste Building and the Auxiliary Building will be evaluated. Supplemental calculations (CIC #2:01.7.7) performed to date on these exterior walls reached one or more of the following conclusions:

1. The load combination with the 0.9 factor did not control the design.

2. Load increases due to this load combination were so small (less than 0.1%) as to be negligible, and

3. Adequate design margins exist to cover a reduction in dead load.

Thus, in each case evaluated to date the Perry load combinations were found to be conservative and the design adequate for the design loads. Results of the remaining analyses will be available by January 31, 1985.

04.7-3 (Observation) Height of Fuel Pool Walls

Summary of Item

This item recommends that seismic sloshing of water within the Fuel Handling Building (FHB) fuel pool be documented in G/C design criteria so that future modifications to equipment in the vicinity of the fuel pool can be designed with consideration of proper environmental effects.

Response

As discussed in the IDI Report, structural calculations for seismic sloshing of water in the FHB fuel pool predict a fuel pool slosh of 8.74 feet with a freeboard of only one foot. The spent fuel has adequate coverage when lifted 14 feet during refueling; therefore, a slosh of 8.74 feet will not result in loss of sufficient water to be a problem. Secondly, the only equipment in the area of potential wetting consists of valves which have already been qualified for a 100% humidity environment. We agree with the IDI Report that these two factors show that sloshing of water does not have any design impact.

Nonetheless, in response to this item, the Plant Environmental Conditions Report will be revised by March 1, 1985, to reflect the potential wetting of equipment in this area of the fuel pool by fuel pool slosh during a seismic event. No other action and no hardware modifications are required.

3.4 ELECTRICAL POWER

Set forth below are our item-by-item responses to the electrical power Deficiencies, Unresolved Items, and Observations identified in the IDI Report. The number and title of each item are taken directly from the IDI Report:

D5.2-1 (Deficiency) Diesel Generator Loading

Summary of Item

This item states that the standby diesel generator load list was not treated as a formal design document. The item further states that the information contained in the load list was not design verified and that this approach resulted in errors and inconsistencies relating to the extent and timing of diesel generator loads.

Response

This item states that there was no verification of the standby diesel generator load list, contrary to DCP 2.05. The item states that the load list is "the only comprehensive history of loads applied to the diesel generator." We do not believe that the treatment of the standby diesel generator load list was inconsistent with DCP 2.05. DCP 2.05 verification requirements apply to formal design documents. The load list is not used as a formal design document, and therefore was not covered by DCP 2.05. The diesel generator loading sequence logic (reference 1 in this item) was design verified. This logic contains a comprehensive history of loads applied to the diesel generator and is the basis for future modifications. We are not aware of any regulatory or procedural obligation to design verify the load list as an additional review confirming the capability of the diesel generator to supply the loads.

The item incorrectly states that the load list is necessary to procure an adequately sized diesel generator. Procurement of the diesel generator was based on the loads known at the time of procurement. The diesel generator qualification tests enveloped the specification requirements in accordance with IEEE-387 (1977). The qualification tests were conservative based upon the load list and correspond to the larger diesel generator actually purchased. The load values in the diesel generator specification were not intended to be a basis for future modifications and consequently have not been updated.

The item correctly notes that there were discrepancies among various documents containing diesel loading information. These were the result of the timing and sequence of updates of the documents. The assumptions in these documents, which were based on equipment rated values, were conservative and were consistent with the FSAR commitment to use rated values. In addition, sequence and load discrepancies among the documents did not result in significant differences of the total loads for each loading group.

The item states that G/C does not consider other computer electrical tabulations to be design documents. While this is correct, it does not raise a design verification issue because the information contained on these computer tabulations, including the diesel generator load list, is also contained on the other formal design documents.

Nonetheless, in response to this item, we have voided the load list, and revised Table 8.3.1 of the FSAR. Confirmatory calculations have been performed and again demonstrate that the standby diesel generator capacity is more than adequate to perform its safety function. No additional analysis or hardware modifications are required.

D5.3-1 (Deficiency) Flame Test Documentation Unreviewed

Summary of Item

This item states there is inadequate documentation confirming that internal panel wiring within motor control centers meets flame retardance criteria contained in industry standards and related project specifications and procedures.

Response

The concerns in this item relate to the fact that Motor Control Center Specification SP-557 does not contain a requirement that internal wiring be flame retardant and conform to the requirements of IEEE-383(1974) or equivalent flame test standards. Although, as noted in the item, the motor control centers do contain flame retardant wire, it is correct that the specification, and documentation referencing the requirements did not reference IEEE-383(1974). The flame test criteria in IEEE-383(1974) are not mandatory for motor control center internal wiring, as noted in the background section of the IDI Report. Accordingly, the absence of a reference to IEEE-383(1974) in SP-557 or the related project documentation discussed in this item is not the basis for a deficiency.

The item states that internal wiring must meet the flame retardance characteristics set forth in IEEE-383(1974) for purposes of FSAR commitments. FSAR Table 8.1-2, referenced in this item, states that "[c]ables, field splices and connections are type tested in accordance with IEEE Std. 383-1974." The Table does not mention motor control center wiring. Thus, there was no lack of compliance with FSAR Table 8.1-2.

Accordingly, the absence of a reference to IEEE-383(1974) in SP-557 or the related project documentation discussed in this item is not the basis for a deficiency. The item states that under Appendix J of the Project Procedures Manual, there should have been a revision of the Manufacturers Documentation Submission List (MDSL) to require the manufacturer to provide flame test documentation for IEEE-383(1974) qualification, and for engineer review and approval. Appendix J only required that items contained in project specifications be recorded on the MDSL. Because, as explained above, SP-557 did not require conformance with IEEE-383(1974), the Appendix J requirement to document specification items was not applicable.

Thus, the use of flame retardant wire in motor control centers represented a conservative approach in excess of the specification requirements. No additional corrective action or hardware modifications are required.

D5.4-1 (Deficiency) Battery Voltage Selection

Summary of Item

This item states that the selection of minimum battery and DC equipment voltages did not consider the effects of voltage drop.

Response

We feel that the battery and equipment selection process did adequately consider minimum operating voltage ratings and the effects of cable voltage drop. The item identifies three pieces of equipment which according to the item may have insufficient voltage at DC system minimum voltage conditions. The three cases cited are not typical.

The first two pieces of equipment, the inverter and the Emergency Response Information System (ERIS) power supply, were not generally available for purchase at lower voltage capabilities. This equipment was purchased several years after the minimum battery voltage was established and it is likely that the designers considered the direct current equipment minimum operating voltage. For example, the designer was aware that the inverter was only required to operate for one hour and, at the end of one hour, the battery voltage would be higher that the voltage required to operate the inverter, i.e., voltage drop would not be a factor.

In any case, prior to the IDI, a review had been initiated in response to an INPO recommendation issued to all nuclear plants regarding excessive AC and DC control circuit voltage drop. This review is discussed in our response to item D5.7-3. The review has determined that the equipment covered by this item (inverters, ERIS power supply and DC motor operated valves 1E51-F063) will perform their required functions. Further, in response to this item, all batteries, DC equipment, DC control circuits, and DC motor operated valves will be verified in conjunction with our response to item D5.7-3 to assure proper operation, including the effects of voltage drop. The concerns raised during the IDI on this item and other related items have been factored into this review.

D5.4-2 (Deficiency) Direct Current Power Cable Sizing

Summary of Item

This item states that some DC power cables may be too small to provide the required current and voltage during starting and operating conditions.

Response

The original cables were sized to safely provide the required current. The sizing of the DC power cables was based on Project Design Criteria Table 2.7.7, which is consistent with the reference in FSAR Section 8.3.1.4.3 to Insulated Power Cable Engineers Association (IPCEA) Standard P-54-440. We believe that Table 2.7.7 is consistent with Design Criteria Table 2.7-2, which references IPCEA Standard P-54-440, considering the 2-conductor and diameter correction factors included in the standard and installation conditions. It is inappropriate to directly compare Table 2.7.7 with the tables contained in IPCEA P-54-440 without considering these factors. The DC circuit fuse sizes were selected on the basis of the current-carrying capabilities of the cable from Table 2.7.7. The cables are large enough to safely provide the required current, because the fuse size is consistent with the current capability of the cable. Thus, the cable temperature will not rise to a higher than rated value.

This item also states that the cable may be too small to provide adequate voltage, because of excessive cable voltage drop. The voltage drop calculations to confirm the adequacy of the DC cable sizes are addressed in our response to item D5.7-3.

In response to this item, a calculation has been performed to confirm the consistency of IPCEA Standard P-54-440 with Table 2.7.7. The calculation substantiates that the DC cables are adequately sized. In addition, the G/C Project Design Criteria has been revised to minimize any future confusion regarding the use of Table 2.7.7.

No additional reanalysis or hardware modifications are required.

D5.4-3 (Deficiency) Battery Sizing Calculation

Summary of Item

This item states that due to inconsistencies and unconfirmed assumptions in the battery sizing calculations, the existing batteries may be undersized.

Response

This item questions certain assumptions that were made in individual revisions to the battery sizing calculations. The assumptions in question are not significant to the overall battery size calculated.

The first assumption discussed in the item relates to the fact that manufacturer's data for Control Complex panel loads was not expressly referenced in the calculation. The load information was supported by available data and the originator did not believe that the data represented a critical characteristic of the calculation requiring documentation.

The second assumption discussed in this item relates to the originator's decision to use actual inverter loads to calculate battery size. although this assumption was technically acceptable, the inclusion of the inverter spare capacity would have been more conservative.

The next concern stated in the item is that the calculation log did not reference the inverter efficiency assumption. As required by G/C Engineering Instruction Number 2, the only assumptions listed in the calculation log were those that require later closeout. The originator did not include the conservative assumption of the inverter efficiency in the calculation log because it was not an assumption requiring later closeout. For similar reasons, the decision to use rated voltage rather than actual voltage was appropriate because the conservative factors were used.

The next concern states that it was unconservative to assume that the inverter was only operating for one hour. We agree that the absence of an automatic timed shutdown would cause the inverter to continue to operate beyond its required one-hour duty cycle; however, the additional amount of load imposed by the inverter after one hour would not have significantly effected the overall load profile.

The final concern is that an inappropriate temperature correction factor was used. The temperature correction factor of 1.0 was based on cell temperature of 77°F. The use of a 77°F cell temperature is consistent with the 72°F ambient temperature, because the cell temperatures are usually higher than battery room ambient temperatures due to the heating effect of trickle current flow to the battery. Nonetheless, the use of a lower (72°) cell temperature in the calculation would have been insignificant (3% capacity increase) to the battery size.

This item also states that the temperature used in the calculations is inconsistent with Technical Specifications. This concern is addressed in our response to item D5.4-7.

In response to all of the above items, a calculation was performed (Calculation R42-11) to reconfirm the adequacy of the Division 1 and 2 batteries. The calculations were performed in accordance with IEEE-485(1978) and applicable procedures, and included the latest loading data and temperature correction factors.

It was confirmed that the previous calculations were conservative and that the Division 1 and 2 batteries have sufficient capacity with margin to supply the loads. For these reasons, no further analysis or hardware modifications are required in response to this item.

D5.4-4 (Deficiency) Battery Charger Sizing

Summary of Item

This item states that there was an inconsistency between the design basis of the Division 1 and 2 battery chargers and resulting calculations relating to the battery chargers.

Response

The two calculations performed subsequent to the preparation of the procurement specification for the battery chargers are consistent with the design basis and project requirements. As noted in this item, in preparing the specification, the designer took the conservative approach of using the battery nominal eight-hour ampere-hour rating. The battery chargers were purchased at the 400-ampere rating in accordance with the specification. The only purpose of the two subsequent calculations discussed in this item was to confirm that the chargers could supply the maximum steady state direct current loads while recharging the batteries from the actual discharged state. For this purpose the use of actual rather that nominal values was appropriate. The calculations were not used to size the battery charger.

For these reasons it is unnecessary to revise the design basis or calculations. No additional analysis or hardware modifications are required.

D5.4-5 (Deficiency) Battery Specification Errors

Summary of Item

This item states that there was a failure to follow G/C Engineering Instructions and Procedures because calculations used in specifying the battery capacity in Specification SP-554 were not checked prior to procurement, and because the specification did not include environmental temperature data relating to battery qualification.

Response

None of the G/C Engineering instructions and procedures referenced as the basis for this item (nor their earlier revisions) were in effect at the time the specification was issued. The instructions and procedures that were in effect at the time of the calculations were followed in the specification process for this equipment. For the reasons described in the impact section of this item, the item does not call into question the adequacy of SP-554 and the qualification of the batteries. Accordingly, no further analysis or hardware modifications are required in response to this item.

D5.4-6 (Deficiency) Direct Current System Maximum Operating Voltage

Summary of Item

This item states that there is a "documentation problem" with G/C's response to the NRC's request for additional information, RAI 430.91, involving the responses' description of actual maximum operating voltage of DC equipment, and that the high voltage alarm should be lowered to provide better overvoltage protection for Class 1E DC equipment.

Response

We agree that the response to RAI 430.91 was incorrect and should have stated that all DC equipment is rated for 140 volts maximum rather than 145 volts as stated in the response. We further agree that a high voltage alarm setting of 140 volts would provide better overvoltage protection for DC equipment. Accordingly, the response to RAI 430.91 has been corrected in Amendment 15 of the FSAR, and the high voltage alarm setpoint will be reduced to 140 volts by March 1, 1985. No further analysis or hardware modifications are required in response to this item.

D5.4-7 (Deficiency) Battery Room Temperature

Summary of Item

This item states (1) that the alarm setpoint in the battery room will not detect a loss of battery capacity because it does not have a low temperature setpoint, (2) that there is an inconsistency between the M23 (HVAC) System Description and Plant environmental table temperatures, and (3) that "the proposed Technical Specification appears to be in error because it was not specifically written for the Perry battery temperature condition."

Response

On the first point, there is no need to have a low temperature alarm to assure battery capacity because the battery room temperature will not fall below 72°F, as noted in Plant Environmental Conditions Table EC.5. The battery is sized for the minimum temperature (72°F) under any condition for this zone. The design and installation of the batteries is consistent with IEEE-484(1975) and Regulatory Guide 1.128 which do not require a low temperature alarm.

On the second point, there is no need to include a minimum temperature in the HVAC System Description. There is no requirement that all environmental data in the FSAR Environmental Tables be duplicated in the System Descriptions. In any case, as noted above, low temperatures will not occur in the battery room.

Regarding the final point, the proposed Technical Specification declares the battery inoperable when the average electrolyte temperature of ten cells is below 60°F. This temperature is consistent with the current carrying capability of the battery, i.e., the battery can supply the required loads at a temperature of 60°F or above. However, we agree that raising the temperature in the Technical Specification will allow full utilization of available margin in the battery. Accordingly, we will assure that the minimum cell temperature in the final Technical Specifications will be consistent with the corresponding temperature in the Environmental Tables. No additional analysis or hardware changes are required.

D5.5-1 (Deficiency) Containment Electrical Penetration Calculation Discrepancy

Summary of Item

This item states that there are documentation discrepancies in design drawings and one calculation relating to electrical penetration protection.

Response

This item states three concerns with a penetration protection calculation. The first concern noted is that the design drawings are inconsistent with as-built conditions in that a back-up fuse which protects a penetration was not shown. The design drawings were consistent with the as-built condition. The as-built conditions, including the back-up fuse, are shown in the vendor wiring diagram and instruction manual. The back-up fuse was not shown on the elementary diagrams ("design drawings"). It is not unusual for vendor diagrams and manuals to contain more detail than is contained in the design drawings. In this case there was no governing requirement necessitating inclusion of the fuse on the design drawings. For these reasons we do not believe there is any inconsistency. Nonetheless, to be responsive to the IDI concern, the design drawing will be revised to show the fuse. The drawing will be revised by March 1, 1985.

The second concern is that, contrary to G/C Engineering Instruction Number 2, Calculation CAL-R24-003 did not reference the Shawmut fuse curve as a design input and approved vendor submitted fuse curves were not obtained. The calculation indicated that a Shawmut fuse was used but did not attach the corresponding fuse curve. We believe that the reference to the fuse in the calculation constituted a sufficient indication of the design input, and that no further detail was necessary to satisfy the general requirements of G/C Engineering Instruction Number 2 that calculations identify design input and sources. With regards to vendor approval, the calculation included a G/C developed fuse curve which was based on the manufacturers technical literature. In this case, the better practice would have been to include an explicit reference to the source of the curve; however, we do not believe G/C Engineering Instruction Number 2 required that approved vendor-submitted fuse curves be obtained.

The third concern is that the calculation used Bussman fuse curves marked "for reference only" rather than vendor approved curves specific to the fuse. Although the better practice would have been to obtain vendor approval, there was no requirement to obtain specific fuse curves approved by the manufacturer for the calculation. The average fuse clearing time curves were used in this calculation with sufficient margin to compensate for the known fuse tolerance and assure coordination and protection of the penetration conductors. Thus, the curves used in the calculation were technically adequate.

Nonetheless, to be responsive to this item, manufacturer's (Bussman and Shawmut) approved curves have been obtained, compared to the original curves, and attached to the calculation. No design changes have resulted from this item. G/C has reviewed the other calculation using Bussman fuse curves. The curves submitted by the manufacturer are consistent with those used in the original calculations. The band represented by the fuse minimum melting time and total clearing time is within the tolerance anticipated in the calculations and factored in the margin. The review has confirmed the observation in the IDI Report, that the documentation discrepancy has not effected the validity of the calculation in demonstrating that penetrations are protected.

No additional analysis or hardware modifications are required in response to this item.

D5.6-1 (Deficiency) 4000-Volt Motor Overload Protection

Summary of Item

This item states that the Emergency Service Water pump motor overcurrent relay settings were established based on 75%, rather than 100% of rated motor voltage as identified by response to RAI 430.80. This item also suggests that there was inadequate review and control of all 4-kV relay settings.

Response

We agree that the Emergency Service Water pump motor overcurrent protection was developed on the basis of 75%, rather than 100% of rated motor voltage. The settings were calculated on a 75% voltage basis for these motors, based on the judgment of the engineer that the procurement specification for this particular motor permitted it to operate and supply rated torque at the 70% voltage. Although the settings were technically acceptable, in response to this item the relay settings for the ESW pump motor have been revised to be consistent with our response to RAI 430.80. All other overcurrent relay settings for Class 1E 4-kV motors were reviewed and were determined to have used 100% rated voltage as their basis. Thus, this item is limited to the ESW pump motor.

An additional concern in this item is the overall review and control of all 4-kV relay settings. All 4-kV Class 1E motor overcurrent relay settings were determined in accordance with Nuclear Design & Procurement Procedure 3-0310. Nonetheless, in response to this item and in conjunction with responses to other items related to protective relaying, all calculations for Class 1E protective relaying are being formalized and reverified. This corrective action will be completed by April 1, 1985.

D5.6-2 (Deficiency) 460 Volt Motor Overcurrent Protection

Summary of Item

This item states that settings for Class 1E 460 volt motors were not in accordance with our response to NRC request for additional information RAI 430.80, which states that long time overcurrent protection is approximately 150% of the full load current.

Response

We agree that the long time overcurrent setting criteria for Class 1E motors of approximately 150% of full load current specified in our response to RAI 430.80 was not met in all cases. As noted in the IDI Report, personnel performing the calculation were not aware of the response to RAI 430.80. A review of all Class 1E 480 V motor feeder breakers has been made and new settings issued where required to be consistent with our response to RAI 430.80. The setting for breaker EF1A05 (reference 9 of this item) was determined to be consistent with the approximately 150% value and was not changed. As noted in response to item D5.6-1, all protective relaying calculations are being formalized and reverified to assure that design inputs are included in the calculations.

D5.6-3 (Deficiency) 4000 Volt Motor Test

Summary of Item

This item states that no procedure exists to ensure proper review and retention of motor starting data by the relay engineer.

Response

We agree that the retention of motor starting data by the relay engineer is not procedurally addressed. Initial operation of 4 kV motors is accomplished in accordance with procedure GEN-E-005. This procedure does address recording and retention of motor starting data, but does not require this data to be recorded while the motor is starting under normal operating load. Motor starting data taken while the motor is starting under normal operating load is the most meaningful data for the relay engineer to use to confirm motor characteristics.

In response to this item, procedure GEN-M-013 will be issued by February 15, 1985, to assure that 4 kV Class 1E motor starting data necessary for the relay engineer to confirm motor characteristics is recorded and sent to him for his review and retention. Motor starting data for all 4 kV Class 1E motors will be provided in accordance with this procedure. No hardware modifications or further analysis are required in response to this item.

D5.6-4 (Deficiency) Motor Control Center Breaker Coordination

Summary of Item

This item states that a DC fuse/relay coordination curve was incorrectly plotted, and that a motor control center feeder breaker overcurrent relay was incorrectly coordinated with the largest load on that motor control center. This item also states that motor control center feeder breaker overcurrent relay setting calculations should include all normally connected and running loads rather than the largest load.

Response

We agree that the DC fuse/relay coordination curve for DC circuit breaker ED1BC6 incorrectly used current units that were different than those used for the fuse curve. In response to this item, this curve has been replotted, which resulted in no setting changes. All other DC fuse/relay coordination curves were reviewed and all were found to be plotted correctly. Therefore this was an isolated instance.

We also agree that our program requires motor control center feeder breakers to be set to coordinate with the largest fuse in that motor control center. AC breaker EF1B09, identified in this item, was recognized prior to the IDI, along with other breakers, as not sufficiently coordinating with fuses for the instantaneous trip function. New trip devices are required to achieve sufficient coordination and these were ordered prior to the IDI. The new trip devices will assure proper coordination.

In response to the final concern in this item, it is consistent with industry practice to set overcurrent relays for motor control center feeder breakers considering only the largest load and not all normally connected and running loads. In conjunction with responses to other items related to protective relaying, all calculations for Class 1E protective relaying are being formalized and reverified. This effort will consider the effects of normally connected and running loads. As noted in our response to item D5.6-1, corrective action will be completed by April 1, 1985.

D5.6-5 (Deficiency) DC Fuse Characteristic Curves

Summary of Item

This item states that the coordination studies for fuses and circuit breakers used average catalog fuse curves and the median of the circuit breaker relay characteristics without the use of tolerances.

Response

We agree that the coordination study was done on the basis of average catalog fuse curves and the median of circuit breaker relay characteristics. In establishing the relay settings, the engineer determined that sufficient margin existed to assure coordination when using the "average" values for fuses and relays. The use of average values for fuses and relays in establishing relay settings is consistent with industry practice. Therefore adequate coordination was achieved without using vendor submitted fuse curves.

Nonetheless, in response to this item and in conjunction with responses to other items related to protective relaying, all calculations for Class 1E protective relaying are being formalized and reverified. This review will include use of the vendor submitted fuse curves and minimum tolerance band of the relay curve. It is anticipated that these changes will have no effect on the settings previously determined. As noted in our response to item D5.6-1, corrective action will be completed by April 1, 1985.

D5.6-6 (Deficiency) Motor Control Center Protection and Coordination

Summary of Item

This item states that in one case, fuse sizing was not consistent with the FSAR, and in another case, coordination was not demonstrated.

Response

The FSAR states that motors fed from motor control centers are protected with fuses rated at approximately 125% of their full load current. We agree that this requirement was not met in one case, for the room ventilation return fan motor fuse. The fuse should have been rated at 150 amperes, and will be changed. There are no safety implications with using the larger fuse, because the motor will perform its safety function with the larger fuse. A design change will be issued by March 1, 1985 to modify the fuse size.

The item also states that adequate coordination has not been demonstrated between a 175 ampere motor control center fuse and the downstream 110 ampere fuse for the Division 3 ESW pump motor. Since all loads fed from this motor control center are in direct support of the operation of the Division 3 ESW pump motor, coordination is not critical.

In light of the above, no additional analyses or hardware modifications are required.

D5.7-1 (Deficiency) Inadequate Cable Voltage Drop Calculation

Summary of Item

The item states that the cable voltage drop at bus low voltage conditions for circuits covered by Calculation CAL-R31-U01 exceeded the cable voltage drop limit of 3% during starting of a motor operated valve. The item further states that the excessive voltage drop may result in a motor terminal voltage below the motor specification (SP-568) requirements.

Response

The item states that the IDI team performed a calculation to determine voltage drop during starting of the valve, and that the team performed this calculation "[u]sing the methods of CAL-R31-001." Calculation R31-001 and the assumptions therein were performed to determine voltage drops during normal running conditions, and is not applicable to voltage drop during starting. For example, the assumption of 0.9 load power factor used in the IDI calculation would not apply during starting of the valve. Similarly, the 3% cable voltage drop limitation in Engineering Design Guide 3.1.1 applies only to normal running conditions and is not applicable during starting conditions as assumed in this item. The voltage drop applicable during starting is 10% as required by the valve motor capabilities specified in SP-568. It appears that the use of the above assumptions led to the concern in the IDI report that the motor voltage was below specification requirements.

Although no specific calculation for voltage drop during starting was performed, there was adequate confidence that the cable size limited voltage drop and assured adequate voltage to the valve during all conditions. Cable size limits voltage drop because cables are derated for routing conditions with an additional 1.25 oversizing design factor. Also, circuit lengths were limited by criteria utilizing conservative current valves to achieve a 3% maximum voltage drop at full load. The above factors gave confidence that the cables were adequately sized for starting conditions.

Nonetheless, in response to this item, calculations have been performed to determine voltage drop during starting for all AC motor operated valves under SP-568. The calculations have shown that all safety-related motor operated valves under Specification SP-568 are capable of performing their safety function during starting and normal running conditions. For these reasons no further analysis or hardware modifications are required in response to this item.

D5.7-2 (Deficiency) Calculation Design Input Not Referenced

Summary of Item

This item states that Calculation CAL-R31-001 does not reference National Electrical Code NFPA-70 as a source of design input to the calculation, contrary to the requirements of G/C Engineering Instruction No. 2.

Response

G/C Engineering Instruction No. 2 does not require that NFPA-70 be referenced in Calculation CAL-R31-001. G/C Engineering Instruction No. 2 applies to the identification, preparation, review, approval, revision, and retention of calculations. Section 3.3(2) of Engineering Instruction No. 2 requires that calculations identify design inputs and their sources. Calculation CAL-R31-001 includes as design inputs values contained in Electrical Department Project Design Criteria, Rev. 3, dated 7/30/82, Tables 2.7-1 through 2.7-7. The source of these values is correctly identified as the Project Design Criteria. In order to meet the requirement of Section 3.3(2), it was not necessary to further identify NFPA-70 as the source of the Project Design Criteria tables.

However, in response to this item, the Project Design Criteria has been revised to include a reference to NFPA-70. We agree that this item does not affect the validity of the calculation or the design. No further action is required.

D5.7-3 (Deficiency) Inadequate Review of Maximum Allowable Circuit Lengths

Summary of Item

This item states that the acceptability of a space heater circuit length was based upon an incorrect load assumption, and that circuits entering containment were not correctly evaluated for allowable length.

Response

The item correctly notes that in the special computer run for long cables the engineer accepted the routed cable length for a nonsafety-related heater using an assumed heater load lower than the actual heater load. Because, in this case, the engineer was dealing with a nonsafety load, he did not confirm his assumption by reviewing the vendor data. We agree that once the engineer had decided to evaluate this circuit, he should have confirmed this assumption. In response to this item, we have evaluated this heater and have confirmed that the heat supplied is adequate.

In addition, this item correctly states that circuits entering containment were not properly evaluated for allowable length. As noted in the IDI Report, an effort had been initiated to evaluate circuits with possible voltage drop problems. This evaluation, which began prior to the IDI, was initiated in response to an INPO recommendation issued to all nuclear plants (INPO Significant Event Report 80-83) regarding excessive AC and DC control circuit voltage drops. The evaluation has been expanded to include specific concerns identified in the IDI report. In response to this specific item, the evaluation is complete for circuits entering containment. Based on the results of the evaluation to date, we have not identified any unacceptable voltage drops for these circuits. The overall voltage drop evaluation is scheduled to be completed by April 1, 1985. No additional analysis or hardware changes for containment circuits are required in response to this item.

D5.7-4 (Deficiency) Omission in Calculation

Summary of Item

This item states that Calculation CAL-R31-001 incorrectly used the results of the 250 volt-ampere control transformer calculation to limit voltage drop of 125-VDC circuits. The item also states that allowable circuit length for #8 AWG conductor routed in conduit is missing from a design criteria table.

Response

The first part of this item relates to the use of a control transformer calculation to limit voltage drop in a DC control circuit. We agree that 125-VDC control circuits were not represented by the generic control circuit configuration used in Calculation CAL-R31-001. The decision to apply the 300-feet calculated maximum length for 125-VAC control circuits to 125-VDC control circuits was based on minimum battery and device ratings as well as switchgear current requirements. However, this decision was not documented in the calculation. Calculation CALR31-001 will be revised by February 15, 1985 to specifically address voltage drop in the 125 Volt DC control circuits.

The second part of this item states that a wire size (#8AWG in conduit) is missing from Table 2.7.7 in the Project Design Criteria. The particular DC circuit discussed in this item, circuit 1R42D5A to DC distribution panel 1R42-S012, is a power feeder rather than a control circuit. This power circuit was represented in Calculation CAL-R31-001. Since this circuit is routed predominantly in tray, the allowable circuit length for #8 AWG routed in cable tray was used, which is shown in Table 2.7-7 of the Electrical Department Project Design Criteria. Table 2.7-7 does not show a maximum circuit length for #8 AWG conductor with a 30 ampere fuse routed in conduit, because the Design Criteria only require that a smaller #10 conductor be used for a circuit with this fuse size if the circuit is routed entirely in conduit. Thus, the design criteria table was properly applied in this case, and there is no need to include the circuit length for conduit in the table.

No additional corrective action or hardware modifications are required to respond to this item.

D5.7-5 (Deficiency) Division 3 Emergency Service Water Pump Cable Size

Summary of Item

This item states that a one-line drawing was not updated to agree with the cable size as shown on an Engineering Change Notice (ECN).

Response

We agree that the drawing had not been updated to reflect the change on the ECN. The Perry Procedures Manual, Appendix N, requires that all documents to be revised as the result of an ECN be listed in Part E of the ECN form. ECN 8318-33-1861 changed the size of the cable for a 75 horsepower motor to two #4 conductors. The block diagram for the motor was properly referenced on the ECN and revised. However, the reference to the one-line diagram was inadvertently omitted from the ECN. Therefore, the one-line diagram was not revised to reflect this change.

In response to this item, ECN's have been issued to reference the one-line diagrams. In addition, we will review all one-line diagrams, to assure that the one-line diagrams agree with the authorized field changes and that the programmatic requirements contained in the Perry Procedures Manual have been properly implemented. There are no hardware modifications required to address this item. The review of one-lines will be complete and documentation discrepancies will be resolved by April 1, 1985.

D5.7-6 (Deficiency) Cable Pulling Calculation

Summary of Item

This item states that Perry Project Organization personnel determine pulling tensions for cables in duct banks by extrapolation without a documented technical basis for the extrapolation. The item further states that the electrical contractor hand pulled cable in cable trays without performing tension calculations.

Response

This item states that extrapolation of the values in the tables for cable pulling tensions is without technical basis. There was adequate technical basis for the extrapolation. Based on manufacturers' data, G/C developed tables of maximum allowable pulling tensions for use by the electrical contractor in installing cable SP-33, the electrical construction specification, incorporates these tables and requires that the contractor determine the maximum allowable pulling tension based on the number and types of cable in the pull, and the bend radius of raceway or conduit. Although the maximum allowable pulling tensions for most cables were determined by the contractor, maximum tensions for cables pulled through duct banks were determined by Project Organization personnel, approved by G/C site engineering, and provided to the contractor on Raceway and Cable Installation Modification (RCIM) forms. As discussed in this item, extrapolation of allowable pulling tensions from the SP-33 tables was necessary because the highest value shown is for a bend radius of 25 inches, while the bend radius of the duct banks is 48 inches. The extrapolations were documented on a sheet attached to each RCIM. The technical basis for the extrapolation is that allowable pulling tension is directly related to the bend radius. This relationship is evident from the tables, and it was not considered necessary to document the basis for the extrapolation. As noted in this item, these calculations resulted in a conservative limit on pulling tension.

With respect to hand-pulling of cable, we interpret that the electrical contractor's procedure as allowing hand-pulling of cable in cable trays without calculating pulling tensions. L. K. Comstock's Cable Pulling Procedure 4.3.3, Section 3.2.10 states in part that "[c]ables pulled in trays by hand, where a man is stationed a maximum of every 100' and at offsets and penetrations shall not require a tension limiting/measuring device." If tension is not required to be measured during hand-pulling, there is no reason to calculate a maximum allowable tension.

Based on the above, no further analysis or corrective action is required in response to this item.

D5.7-7 (Deficiency) D.C. Control Circuit Cable Sizing

Summary of Item

This item states that there is a DC control circuit which exceeds the criteria for maximum length contained in project criteria, and that voltage drop has not been adequately evaluated.

Response

There are no specific regulatory requirements or industry standards which establish the extent to which voltage drop calculations be performed on Class 1E circuits. We agree that due to its excessive length, the circuit in question should have received additional analysis for voltage drop to assure that sufficient voltage is available for the circuit to perform its required function at nominal voltage. An additional evaluation of this circuit is required to verify its capability at reduced voltage. This particular circuit has been analyzed and tested, and the circuit performs its required function. As noted in our response to item D5.7-3, a review of AC and DC control circuits had been initiated prior to the IDI to evaluate voltage drop due to cable lengths which exceed the criteria. This overall evaluation is scheduled to be completed by April 1, 1985.

D5.8-1 (Deficiency) FSAR Discrepancy

Summary of Item

This item states that there are three inconsistencies between the elementary drawings and the FSAR in the description of Emergency Service Water (ESW) Pumps A and B.

Response

The first concern in this item relates to a statement in the FSAR, that pump start is delayed until the diesel circuit breaker closes. This statement applies during a loss of off-site power (LOOP) condition, but does not apply when off-site power is available during a loss of coolant accident (LOCA). A revision to FSAR Section 8.3.1.1.2.8 will be initiated by February 1, 1985, to clarify that there is only a delay in pump start until after closure of the diesel generator circuit breaker in the event of a LOOP.

The second concern identified in this item is that the FSAR description of the pump start circuit is incomplete, because the interlock due to the opening of the discharge valve is not mentioned. In response to this concern, FSAR Section 8.3.1.1.2.8 has been revised in Amendment 15 to describe this interlock.

The third concern in this item is that the pump control is a type 3 control, rather a type 2 control as described in the FSAR. The pump control is not a type 3 control, because the pump is always started by the discharge valve interlock and not directly by a loss of coolant accident (LOCA) signal. Thus, no corrective action is required for this specific concern.

No further analyses and hardware modifications are required on this item.

D5.8-3 (Deficiency) Control Fuse Calculation A Omission

Summary of Item

This item states that the selection of 10 ampere and 30 ampere power fuses for a control circuit was not supported by a calculation.

Response

Calculations were not required to be performed for sizing control circuit fuses. For control circuits which normally contain a number of devices, reliability of the circuit is a more important consideration that protection of any particular device. Thus, in selecting fuse sizes, close coordination between fuses and devices is not desirable. Since the purpose of calculations is to provide such coordination, calculations are not necessary to select control circuit fuse ratings. Rather, control circuit fuses, including the 10 ampere and 30 ampere fuses identified in this item, were sized to provide short circuit protection while preventing spurious trips which would impair the ability of the circuit to perform its safety function. This approach, which is based on engineering judgment and experience, is consistent with industry practice.

Further, the reviewer was able to substantiate the acceptability of the design with respect to fuse rating. The data required for the reviewer to perform an evaluation, including the type of circuit, connected devices, and power source, is contained on the elementary diagrams.

Nonetheless, in response to this item, the G/C Project Electrical Design Criteria will be revised to include general guidance for sizing control circuit fuses. This corrective action will be completed by March 1, 1985. No further analysis and no hardware modifications are required for this item.

D5.8-4 (Deficiency) D.C. Control Circuit Fuse Selection

Summary of Item

This item states that there is an inconsistency concerning minimum cable sizes between two tables in the G/C Project Design Criteria. The item further states that the Emergency Service Water (ESW) switchgear control circuit conductors were provided with a fuse too large to protect the conductors.

Response

The issue concerning an apparent inconsistency between Tables 2.7-7 and 2.7-2 of the Project Electrical Design Criteria was addressed in our response to item D5.4-2. As stated in that response, we believe that Table 2.7-7 is consistent with IPCEA Standard P-54-440. Further, a calculation has been performed which substantiates that DC power cables are adequately sized for the fuses that were selected. In response to this item, the Project Design Criteria has been revised to minimize any future confusion regarding the use of Table 2.7-7.

With respect to the switchgear control circuit conductors addressed in this item, neither Table 2.7-2 nor Table 2.7-7 applies. Those tables apply to power circuits. Our response to item D5.8-3 describes the method by which fuses for control circuits are selected. The 30-A fuses selected for the ESW switchgear control circuits will assure short circuit protection while preventing spurious trips which would impair the ability of the circuit to perform its safety function.

No additional analyses and no hardware modifications are required to address this item.

D5.9-1 (Deficiency) Control Room Duct Fill Criteria Inadequate and Unjustified

Summary of Item

This item states that GE's duct fill for Power Generation Control Complex (PGCC) control room cables is inconsistent with the cable tray fill guideline in the FSAR, and that the duct fill guideline has not been appropriately verified.

Response

There is no inconsistency between the FSAR tray fill criteria and the GE duct fill criteria discussed in this item. The conclusion of the item that there was an inconsistency between the FSAR and GE criteria appears to be based on the finding that "[a] duct completely filled (to the floor plate) with ideally laid cable to eliminate bends may approach a calculated fill much greater than 50%," and that "[t]his practice is inconsistent with the FSAR commitment with respect to filling cable trays to a design objective of 50% of the useable depth." The GE criterion of 40% duct fill is based on calculated cable cross-sectional areas. GE's guideline is based on Licensing Topical Report NEDO-10466A, which has been fully evaluated and approved by the NRC for licensing of PGCC control rooms. As noted in the FSAR Sections cited in this item, a 40% fill design objective using cross-sectional area is approximately equal to a design objective of 50% based on useable depth which is calculated using cable diameter squared for the cross-sectional area of the cables. Thus, there is no inconsistency.

The second item states that there is no verification of the assumption that use of the GE criterion will result in the 40% duct fill. The 40% criterion is a well established standard used throughout the industry to determine adequate cable loading in cable trays or ducts. There is extensive technical basis for this industry standard. The heating effects of cables in the PGCC floor ducts are calculated in the NEDO Topical Report referenced above, and have been similarly evaluated in other reports. An additional Perry Specific analysis is not required to meet the intent of ANSI N45.2.11.

In any case, General Electric has used a computer routing program to design and monitor the PGCC cables at Perry. This program identifies cable duct overfill conditions using the 40% criteria. There have been six cases in the PGCC in which cable ducts have exceeded the criterion. These cases were appropriately evaluated and determined to be acceptable and do not to require hardware modifications.

For these reasons, no further analysis or hardware modifications are required to resolve this item.

D5.10-1 (Deficiency) Electrical Separation Criteria Deficiencies

Summary of Item

This item states that there are several errors, omissions, and inconsistencies in the G/C Project Electrical Design Criteria and construction criteria drawings with respect to electrical separation requirements.

Response

These are nine concerns noted in this item. Our responses to the specific concerns are as follows:

Concern 1

We agree that the reference to NRC Regulatory Guide 1.75, Revision 1 in criteria drawing D-214-005 is incorrect. The design was based on Revision 2, as stated in the FSAR. This change does not affect the design because there are no differences between Revisions 1 and 2 with respect to separation criteria. The drawing will be revised by March 1, 1985 to reference the correct revision.

Concern 2

We do not agree that this concern is an omission in the Project Design Criteria. Although separation requirements for Class 1E to non-Class 1E conduit are not specifically addressed in the Project Design Criteria, the Project Design Criteria references IEEE Std. 384-1974, which contains the separation requirements. As noted in the IDI Report, criteria drawing D-214-004 shows the separation requirements. The separation requirements for Class 1E to non-Class 1E conduit are the same as for Class 1E to Class 1E conduit.

Concern 3

Paragraph 2.8.4(d) of the Project Design Criteria was not meant to imply that separation could be less than one inch as long as conduits are not in physical contact. This provision was intended to be applied in conjunction with Figure 2.5-1, Sheet 2, which shows the design objective of six inch separation. Both the Project Design Criteria and criteria drawing D-214-004 are in compliance with IEEE Std. 384-1974. Nonetheless, in response to this concern Figure 2.5-1, Sheet 2 will be revised to be consistent with the one-inch minimum separation shown in the construction criteria drawing. This corrective action will be completed by March 1, 1985.

Concern 4

There was no omission in the Project Design Criteria or in separation criteria drawings D-214-004 and D-214-005. Separation requirements for Class 1E components within panels are not specifically addressed in these criteria documents because these documents are for the design and construction of raceways. As noted in the IDI Report, construction specification SP-33 specifies the applicable separation requirements.

Concern 5

It is not necessary to show the Division 3 power tray identification symbol or the Division 4 instrumentation tray identification symbol in drawing D-214-005. The only power tray in Division 3 is a random lay power and control tray. The symbol for this tray is shown on criteria drawing D-214-005. Division 4 does not contain any trays, including logic trays. Thus, there is no omission.

Concern 6

This concern is related to concern 3. Figure 2.5-1, Sheet 2, of the Project Design Criteria shows a minimum separation distance of six inches, while criteria drawing D-214-004 shows a minimum separation of one inch. Both the Project Design Criteria and drawing D-214-004 are consistent with IEEE Std. 384-1974, which requires a minimum separation of one inch. In response to this concern, Figure 2.5-1, Sheet 2, will be revised to be consistent with the criteria drawing. This corrective action will be completed by March 1, 1985.

Concerns 7, 8, and 9

The one-inch minimum required separation distance between barriers and raceways is not shown on some details of barrier criteria drawing D-201-146, Sheet 1. The separation requirements are set forth in IEEE Std. 384-1974, and there is no need to duplicate the detailed information on each drawing. Nonetheless, in response to this concern, all details of criteria drawing D-201-146, Sheet 1, which do not show the minimum one-inch separation distance will be revised to include it. This corrective action will be completed by March 1, 1985.

A general concern of the IDI item appears to be that design criteria documents are not always revised to reflect detail included in construction specifications or drawings. We do not agree that all details specified in construction specifications or drawings are required to be reflected in the project design criteria. The IDI Report observes that separation requirements were correctly shown in construction specification documents. These specification documents are used in conjunction with criteria drawings for the field installation of equipment and raceways. This assures the field installation is in accordance with the design requirements.

In light of the above, no further analyses and no hardware modifications are required to address the concerns in this item.

D5.10-2 (Deficiency) Violation of Separation Criteria for Mechanical Damage Zones

Summary of Item

This item states that an analysis is required to confirm the adequacy of the design of the ESW pumphouse conduit separation, which does not meet criteria established on D-214-004.

Response

A formal analysis was not performed in the case of conduits in the Emergency Service Water Pumphouse. A formal analysis was not deemed necessary based on the following factors: no high energy line breaks or jet zones are located in the pumphouse, the pumphouse crane and safety-related conduit are seismically designed, and the ESW Pumphouse crane operation is administratively controlled. Further, a formal analysis of conduit separation in mechanical damage zones is not required to meet Project Design Criteria, Section 2.8.2. The Project Design Criteria requires analysis of cable tray, when a 20-foot separation criteria cannot be met. Conduit is not referenced in the Project Criteria. Drawing D-214-004, which requires 20-foot separation for both cable tray and conduit, is incorrect.

In response to this item, Drawing D-214-004 will be revised to be consistent with Project Design Criteria 2.8.2 by removing the reference to conduit. The drawing revision will be accomplished by March 1, 1985.

No additional analysis and no hardware modifications are required to respond to this item.

D5.10-3 (Deficiency) Electrical Separation Violations in PGCC Floor Section Raceways

Summary of Item

This item states that there are nonsafety fire protection circuits contained in flexible steel conduit which are in direct contact with safety-related cables within PGCC floor ducts, and that a GE engineering test report is not sufficient to fully resolve the specific deficiencies identified.

Response

The item correctly notes that there were fire protection circuits within conduit that were not separated by a 1-inch air gap from adjacent safety-related circuits. The item cites industry and regulatory standards, which the item states "appear to be applicable" to this case. IEEE Std. 384-1974 establishes requirements which apply to the PGCC floor ducts. For the case of nonsafety fire protection circuits, the requirements of IEEE Std. 384-1974 were met by utilizing flexible steel conduit as a barrier to meet cable separation requirements.

This item states five specific concerns with the testing performed on flexible conduit. Our response to the five specific concerns is as follows:

1. We agree that the documentation of the applicability of Test Report A00-794-6 to the Perry design, was not evident. The applicability of the Test Report is demonstrated by the following comparison of the test configuration with the Perry PGCC configuration:

Parameter	Test Configuration	Perry PGCC Configuration
Wire Insulation	Tefzel	Tefzel/XLPE
Wire Size	#10 AWG	#16 AWG/14 AWG
Conduit Size	3/4" Diameter	3/4" Diameter
Power Source	300 ampere DC	*
Configuration	Redundant Class 1E or 1E and non-1E wiring in adjacent conduits or one in conduit and other in contact with conduit	Redundant Class 1E or 1E and non-1E wiring in adjacent conduits or one in conduit and other in contact with conduit

* Maximum circuit protective devices used in PGCC wiring is 30-ampere fuse or circuit breaker. The test configuration did not use circuit protection devices and the test current was limited only by the #10 AWG wire resistance and source impedance. Thus the test configuration represented the worst case fault condition.

The above comparison applies to the fire protection circuits referenced in this item. The fire protection circuits are low energy instrumentation circuits, with a maximum power consumption of 100 microamperes at 24-VDC, insufficient to damage adjacent wire insulation. The fire protection power supply circuits are protected by 15-ampere fuses, well within the tested envelope of 300 amperes. We believe that a generic test justifying a category of separation conditions, such as those covered by this item, satisfies the intent of IEEE Std. 384-1974 regarding the application of analysis and tests.

2. The test report will not be used to eliminate the 1-inch separation criteria. Wherever practical, a one-inch minimum air gap separation has been maintained between conduits or barriers separating redundant Class 1E wiring, Class 1E and non-Class 1E wiring, and between conduit or barrier and other wiring: The test analysis is applicable to the Perry PGCC, where deviations from one-inch separation exist.

3. The Perry PGCC separation configuration of wiring touching (e.g., fastened and in contact with) a conduit is encompassed by the test configuration. The adjacent wire fastened to the outside of the conduit was monitored during the test. As shown in Figure 6.2C (adjacent wire) and Test Results Data Sheet 6.2 of the DRF A00-794-6 report, the test demonstrated that the adjacent wiring was protected by the conduit barrier from the damaging effect of faults within the conduit. Thus, the test results apply to the cases identified in this item.

4. The parameters for the test were selected to envelope the worst case fault condition and the resulting thermal gain. For example, a thermal gain due to a failed circuit operating at a lower current for a prolonged period will not result in a higher temperature rise that the test condition. The duration of the test was sufficient to reach a steady-state temperature condition. This is supported by the long-term heat flow calculation covered by the Electrical Fault Analysis contained in GE DRF A42-53, which demonstrated that the test condition represented the worst postulated case with regard to thermal damage potential to the wiring in contact with the conduit.

5. Paragraphs 4.3.3(a), 4.3.3(b), 4.3.3(c) and 4.4.3 of GE Specification 22A3728 referred to in this item apply to "devices." These paragraphs do not apply to the case of flexible steel conduit used as a barrier against effects of electrical fault propagation of wiring contained within a conduit. Therefore, no unique identification is deemed necessary for these wiring interfaces. The separations employed in the cases indicated in this report were demonstrated adequate with the use of steel conduit, as justified by the Engineering Test Report. A00-794-6, which covers instances of wiring interfaces conforming to or less severe than the test configuration.

For the above reasons, the test report fully resolves the specific separation concerns identified in this item. Supplemental analysis and additional documentation other than that described above is not required to further correlate the results in the test report with separation concerns within the PGCC.

D5.10-4 (Deficiency) Electrical Separation Violations Within Local Control Panel 1H51-P037

Summary of Item

This item states that there were two separation deficiencies within a local control panel where flexible steel conduit (used as a separation barrier) containing non-Class 1E wiring has Class 1E wiring touching or less than 1-inch distance from the conduit, contrary to IEEE Standards 384 and P420.

Response

The item correctly identifies two cases in a balance of plant local control panel in which Class 1E wiring was less than one inch from conduit containing non-Class 1E wiring. As stated in the item, the conduit was "used as a separation barrier" between safety and non-safety wiring. The item discusses separation requirements contained in IEEE Std. 384-1974. According to the item, Section 5.1 of IEEE Std. 384 contains "guidance" applicable to the two configurations identified. However, Section 5.1 only relates to cables and raceways in general plant areas, and does not apply to internal panel configurations such as those covered by this item. The portion of IEEE Std. 384-1974 applicable to internal panel wiring separation is Section 5.6.2 which states, among other things, that "[i]n the event ... separation distances are not maintained, barriers shall be installed between redundant Class 1E equipment and wiring." The item recognizes that conduit was used as a barrier in this instance, and we believe the applicable provisions of IEEE Std. 384-1974 were satisfied in these cases.

The item correctly notes that G/C Electrical Department Project Design Criteria includes a reference to IEEE Standard P420. The inclusion of this reference was an inadvertent error, since G/C has never intended to apply, and has not used, IEEE Standard P420 in the design of panels. For this reason, IEEE Standard P420 is not referenced in the FSAR. This explains why Specification SP-594 does not include a reference to IEEE Standard P420. The Project Design Criteria has been revised to eliminate the reference to IEEE Std. P420.

The item states that GE Design Specification 22A3728 is "not applicable to the GAI balance of plant design effort," but then states that the specification "provides guidance with respect to interpretation of separation criteria." The item states that the parts of the GE specification which require that analysis be conducted when external wiring is less than one inch from the barrier should be applied to G/C balance of plant panels. The item recognizes the inapplicability of the GE specification, and we do not agree that the specification constitutes "guidance" with respect to G/C balance of plant panels. The applicable portions of IEEE Std. 384-1974 discussed above do not require an analysis of the configuration covered by this item.

For these reasons, no further analysis is necessary to demonstrate acceptability of the design and no hardware modifications are required.

D5.10-5 (Deficiency) Electrical Separation Violation Within Control Room Panels

Summary of Item

This items states that there was Class 1E wiring in contact with flexible steel conduit which contained redundant or non-Class 1E wiring located within the PGCC control room panels, and that a GE engineering test report was not sufficient to fully resolve the specific deficiencies identified.

Response

The item correctly notes that there were six cases where Class 1E wires were in contact with conduit. The item reviews several sections of IEEE Std. 384-1974 and of GE Specification 22A3728, which according to the item, establish 1-inch and 6-inch minimum separation requirements for various configurations in Class 1E systems. The 1-inch minimum distance established in IEEE Std. 384-1974 does not constitute either a requirement or "guidance" applicable to the specific cases listed in this item. The 1-inch requirement is only established for general plant areas and does not cover the control room panels. The applicable requirements for separation within control room panels are contained in Section 5.6.2 of IEEE Std. 384-1974, which states that barriers may be used in a panel where 6-inch separation between redundant circuits cannot be maintained. In the cases noted, flexible conduit has been used as a barrier to separate redundant circuits. The GE Engineering Test Report A00-794-6 demonstrates that flexible conduit may be used as a barrier against the effects of electrical fault propagation as discussed in GE Specification 22A3728, Section 4.3.3(d).

The item identifies five concerns, which it states are not fully resolved by the GE Engineering Test Report. These are the same five concerns as those described in item D5.10-3 for PGCC floor section raceways.

The installed configurations of the panel wiring are analogous to the installed configurations of the floor duct wiring covered by item D5.10-3 for purposes of applying the GE Engineering Test Report. Accordingly, our response to the five concerns in this item is the same as that discussed in our response to item D5.10-3.

For reasons set forth above and as described in our response to item D5.10-3, the test report fully resolves the specific separation concerns identified in this item. Supplemental analysis and additional documentation is not required to further correlate the results in the test report with the separation concerns within the PGCC.

D5.10-6 (Deficiency) Cable Separation Violation at the Recirculation Pump Switchgear

Summary of Item

This item states that there is inadequate physical separation between safety-related Reactor Recirculation Pump control cables and a nonsafety-related cable tray.

Response

This item states that a 3-feet minimum separation is required between safety-related Reactor Recirculation Pump control cables and nonsafety-related instrument tray 2163. Cable tray 2163 is a solid bottom tray and will be covered after completion of cable installation. Because the control circuits identified in this item are installed in flexible conduit and because tray 2163 will be a totally enclosed raceway, the minimum separation requirement is one inch, rather than three feet as stated in this item. Because a one-inch separation was not maintained in this case, in response to this item, this condition has been documented and analyzed as being acceptable without rework. No further analysis and no hardware modifications are required to address this item.

D5.11-1 (Deficiency) Cable Installation Routing Error

Summary of Item

This item states that discrepancies exist in cable routing design documents.

Response

While we agree that for a small number of circuits, documentation discrepancies exist for the last several feet of cable tray route, the discrepancies do not have an effect on the design. These documentation discrepancies result from two different installation conditions. The first condition, where cables exit the cable tray prior to the exit point defined on the pull without including the last tray segment, results in a conservative tray fill calculation for that segment. This is not a design concern, because the actual fill is equal to or less than the calculated fill for any point in the tray. The second condition, where cables exit the cable tray at a location several feet beyond the exit point defined on the pull slip, effects the tray fill calculation only by a small amount. The total heating effects of these minor additions to the fill are negligible.

The corrective action for this item was accomplished in November 1982. Prior to November 1982, the contractor's cable installation program allowed cables to be pulled to the vicinity of the termination and coiled for future termination. A quality control inspector would then sign the pull card validating the acceptability of the pull. The termination procedure allowed for final routing to the termination. In taking the most direct route, in some cases the terminator deviated from the last several feet of tray in the route. In November, 1982, the contractor's program was enhanced to assure that small segments of tray not utilized were documented on a Raceway and Cable Installation Modification (RCIM) form.

The two cables identified in this item were pulled to the vicinity of the termination. This pull was then properly validated by the contractor's quality control. During the termination process, the final routing deviated from the small tray segment identified on the pull slip. This deviation resulted in a more conservative tray fill. RCIM #2779 has been issued to correct the documentation discrepancy.

As discussed above, other discrepancies such as these will have no impact on the adequacy of the design. No hardware changes and no further analysis are required in response to this item.

D5.12-1 (Deficiency) Reduced Starting Voltage Criteria Inconsistency

Summary of Item

This item states that there are inconsistencies among the G/C Design Criteria, the FSAR, and the motor procurement specification regarding the ability of motor-operated valves to start at reduced voltage.

Response

The design criteria and FSAR are consistent with Specification SP-568 for Class 1E electric motor-driven valve operators. The 75% voltage criterion contained in G/C Design Criteria, Section 2.3.7(7), FSAR Section 8.3.1.1.4, and in the response to NRC Request for Additional Information RAI 430.104, applies to motors that drive large rotating equipment. The 75% voltage criteria is not applicable to electric motor-driven valve operators.

The item also states that "reduction in bus voltage can occu due to loss of power, degraded grid voltage and voltage drop due to large motors starting and diesel sequencing." On loss of power, the diesel generator will start and supply adequate voltage for valve operation. Voltage drops due to large motor starting at PNPP (regardless of power source) are momentary and not significant with regards to valve operation. We agree that the valves may be required to operate at degraded grid voltage conditions. The valve operator motors (SP-568) have been reanalyzed also (see response to item D5.7-1) under sustained degraded grid voltage (minimum of 96% of rated), and were determined to be capable of performing their function. Thus, the ±10% voltage range in SP-568 for Class 1E electric motor-driven valve operators is acceptable.

In response to this item, FSAR Section 8.3.1.1.4.1 has been revised in Amendment 15 to indicate that the 75% starting voltage is not applicable to motor cperated valves. No hardware changes or further analysis is required in response to this item.

D5.12-2 (Deficiency) Inadequate Calculation

Summary of Item

This item states that there are deficiencies in Calculations R60-001 and R60-002 related to completeness, documentation of assumptions, and methods and use of standard fuse curves.

Response

Our response to the three concerns identified in this item are as follows:

1. We agree that the cover sheet and attached charts were not specifically referenced as part of the calculation. However, the entire package including the charts was identified as part of Calculation R60-001 in the Records Management System. Since the time of the IDI, this calculation was revised for other reasons. The revision contains properly numbered pages. Thus, no further action is required to address this concern.

2. We agree that the calculation did not specifically state the basis for fuse selections. The basis for fuse selection include the use of an identical valve calculation, the use of the three-point plotting method to select fuses from fuse curves, and 94% derating by selecting the next higher fuse size. Although the bases were evident, in response to the IDI concern, we have revised the calculation to clearly reference the methodology.

3. G/C Engineering Instruction Number 2 does not require that approved vendor submitted fuse curves be obtained. However, in response to this item, vendor approved curves have been obtained and incorporated in the revised calculations. These curves did not change the results of the original calculation.

The above response applies to both calculation R60-001 and R60-002. No hardware changes and no further analysis are required in response to this item.

D5.12-3 (Deficiency) Fuse Sizing Criteria Inadequate

Summary of Item

This item states that there is no analytical basis for the sizing of the motor-operated valve fuses at Perry.

Response

There is adequate analytical basis for sizing the motor operated valve motor fuses. The basis for selecting the fuse sizing criteria is as follows. The criteria was established in 1975, shortly after the publication of NRC Branch Technical Position EICSB-27, "Design Criteria for Thermal Overload Protection for Motors on Motor Operated Valves." The fuse selection criteria was consistent with the Branch Technical Position, "to drive the valve to its proper position during an accident rather than be concerned with excess heating." The Branch Technical Position requirement was established to prevent spurious operation of the overload protective device. A commonly used design in valve motor protection is a thermal overload (for overload protection) and a molded-case circuit breaker (for short-circuit protection) in series. Because the Branch Technical Position required that thermal overloads be bypassed (i.e., not in the circuit) during an accident, the molded-case circuit breaker would provide the only protection for the valve motor.

The selection of dual-element fuses to protect valve motors was to improve on the protection philosophy established in the Branch Technical Position by providing overload protection during an accident, still assuring that the valve operation takes precedent over the valve protection. Thus, a fuse size higher than that used in normal commercial or industrial applications (i.e. NFPA 70) was selected. This approach was clearly documented in the SER and accepted by the NRC.

In addition, this item states that the PNPP fuse sizing criteria is such that fuses are "rated at 300% of motor full load current." This is not correct. As noted elsewhere in this item, the fuses are selected so that the "operating point is at least 300% of motor full load current during the normal operating time of the valve." (emphasis added). The implementation of this criteria does not always result in fuses sized at 300% of full load current. Therefore, the conclusion in this item that the fuses are oversized and that the fuses may not provide adequate protection for the motors during normal plant operation is not accurate.

For these reasons, no further documentation of the selection criteria is required.

D5.12-6 (Deficiency) Failure to Confirm Motor Operated Valve Operation at Reduced Voltage

Summary of Item

The item states that there is no documented technical bases to substantiate that the Limitorque valve motor operators, as tested in Limitorque qualification report B0058, will produce the required torque output to operate the valves at 10% below rated nameplate voltage.

Response

The G/C engineer in this case, concurred with the Limitorque report conclusion, which states that the valve operator motor is oversized to provide the required torque at 10% below rated nameplate voltage. The G/C engineer did not require specific documentation to substantiate this conclusion, but based his acceptance of the report on the fact that the report met the requirements of IEEE Std. 382-1972. Although we believe that the engineer's decision was correct, a better approach would have been to provide greater detail in the documentation of the decision.

In response to this item, a review has been performed to compare the torque provided by each operator purchased with Specification SP-568 and the torque required to operate its valve. The review concluded that all of the operators develop torque at 90% of rated voltage greater than that required to operate the valve. Thus, in all cases the requirements of Specification SP-568 have been met.

No hardware changes or further analysis are required for this item.

D5.12-5 (Deficiency) DC Motor Operated Valve Circuit Protection Discrepancy

Summary of Item

This item states that one calculation, R60-001, Rev. 1, was not available for IDI review and was not listed on the calculation log, contrary to the G/C program requirements.

Response

We agree that Calculation R60-001, Rev. 1, was not available for review during the IDI, and should have been listed in the calculation log. However, as noted in this item, the calculation was appropriately identified in the Design Verification Record as having been used by the originator and verifier in the review of the one-line diagram. The calculation had been removed by an engineer without inserting a sign-out card and has now been returned to the Project File. In response to this item, the calculation revision has been added to the log to resolve the documentation discrepancy, and the requirements for administrative control of files have been re-emphasized with G/C personnel. We agree with the IDI Report that this is not a systematic problem. No hardware changes or additional analysis are required in response to this item.

D5.13-1 (Deficiency) Seismic Equipment List

Summary of Item

This item states that the Seismic Qualification Review Team (SQRT) form and Seismic Qualification Summary Report for Emergency Service Water Pump A list the required floor response spectra for the Fuel Handling and Intermediate Building rather than for the Emergency Service Water Pump House. The item further states that the seismic qualification should be based on the pump vendor's seismic report rather than a floor response spectra.

Response

We agree, as stated in this item, that "[t]he correct reference should have been to the pump seismic report which provides the acceleration values that were actually used in the seismic analysis performed by the motor vendor." We further agree that the reference to the Fuel Handling and Intermediate Building floor response spectra is only a documentation error, because the actual acceleration values supplied by the pump vendor were used to seismically qualify this motor.

In response to this item, we have verified that the seismic qualification for the three safety-related vertical pump motors used the correct response spectra. In addition, references in the SQRT form for Emergency Service Water Pump motors 1P45-C001A, B and C have been corrected. The reference corrections in the Seismic Equipment List for these motors will be complete by March 1, 1985. No hardware changes, other documentation changes, or further analysis is required in response to this item.

D5.13-2 (Deficiency) Vertical Motor Required Response Spectra

Summary of Item

This item states that procurement specification SP-550 for Emergency Service Water pumps 1P45-C001A and B incorrectly instructs the vendor to provide seismic qualification based on floor response spectra, rather than the pump vendor's seismic analysis acceleration values.

Response

Although the specification referenced the floor response spectra, the qualification of the motors was based on the pump vendors' acceleration values. These numbers had been supplied to G/C from the pump vendor. At the time of procurement of these motors, Specification SP-550 included the latest information available, which was the floor response spectra. As noted above, when specific pump acceleration information became available, it was transmitted to the motor vendor. Because all motors specified in SP-550 have been received, installed, and qualified, it is not necessary to update the specification.

Nonetheless, in response to this item, the three vertical pump motor combinations purchased by Specification SP-550 have been reviewed. The review confirmed that the appropriate input provided by the pump vendor was used in each case. No hardware changes or further analysis is required in response to this item.

D5.14-1 (Deficiency) Class 1E Motor Operating Voltages

Summary of Item

This item states that the voltage study performed in response to Branch Technical Position PSB-1 did not analyze voltage at the equipment terminals, as indicated in the response the RAI 430.77.

Response

We agree that the load flow study during degraded grid conditions did not evaluate voltages beyond the distribution buses. In the development of the response to RAI 430.77, it was believed that, due to the cable derating and cable oversizing factors, the effect of cable voltage drop would not impact the results of the load flow study.

This item also states that, because the load flow studies did not go beyond the distribution buses, additional loading steps may be required on the diesel generator. Branch Technical Position PSB-1 relates to sustained low grid voltage conditions and does not address diesel generators. As noted in the response to item D5.2-1, confirmatory calculations demonstrate that the diesel generators are adequate to perform their safety function.

In response to this item, additional calculations have been performed that extend the modeling to 4 kV Class 1E motor terminals. The calculations have concluded that the cable voltage drop for the 4 kV motors did not effect the results of the earlier studies, which concluded that the voltage at the 4 kV motor terminals during starting and normal running is greater than motor rated. In addition, further analyses are being performed to model worst case conditions at the terminals of 460 V motors. This analysis will be completed by April 1, 1985.

U5.2-1 (Unresolved) Motor Accelerating Times

Summary of Item

This item states that since motor specifications do not require motors to be sized to reached rated speed in the five seconds contained in the loading sequence logic, re-analysis of the diesel generator loading may be required.

Response

We do not agree that the motors are required to accelerate to rated in 5 seconds at 75% rated voltage. The standby diesel generator loading sequence logic, the FSAR, and the load list do not state that the Class 1E motor specifications include a requirement that motors be sized to accelerate loads up to speed within five seconds at 75% of rated voltage. Although the ESW pump motor and other PNPP Class 1E motors are capable of starting at 75% of motor rated voltage, as noted in FSAR Table 8.3.4, the diesel generator has a demonstrated capability of recovering to 90% rated voltage within one second. Because, as noted in this item, loads are added onto the diesel in minimum increments of five seconds, the diesel generator will be at motor full rated voltage at the time that the ESW and other Class 1E motors are applied. Thus, it is unnecessary to assure through specification that Class 1E motors be sized to accelerate up to speed within five seconds at 75% of motor rated voltage during diesel generator operation.

Nonetheless, to respond to the concerns expressed in this item, an evaluation of large motor loads has been performed. Based on the diesel generator rating and demonstrated recovery capabilities, the evaluation indicates that the motors will be up to speed in five seconds.

No additional analysis or hardware modifications are required to address this item.

U5.8-2 (Unresolved) Power Monitor

Summary of Item

This item states that a loss of power monitor was not provided for G/C control circuit used to multiply the GE LOCA logic.

Response

The item states that because a power monitor was not provided for the control circuit in question, a loss of power in the circuit from a blown fuse or disconnect switch inadvertently left open could occur and remain undetected. The item postulates that, during a design basis event, the redundant control circuit could experience a single failure disabling the circuit. In this circumstance, the single failure criterion for protection systems, as required by Section 4.2 of IEEE Std. 279-1971, would not be met.

IEEE Std. 379-1977 addresses application of the single failure criterion to Class 1E systems. Section 4 of IEEE Std. 379-1977 contains the following general statement of the single failure criterion:

> The system shall be capable of performing the protective actions required to accomplish a protective function in the presence of any single detectable failure within the system concurrence with all identifiable, but nondetectable failures, all failures occurring as a result of the single failure, and all failures which would be caused by the design basis event requiring the protective function.

Section 3 of IEEE Std. 379-1977 defines "detectable failures" as "[f]ailures that will be identified through periodic testing or will be revealed by alarm or anomalous indication" (emphasis added).

This item incorrectly assumes that because a power monitor (alarm) was not provided for this particular circuit, loss of power in the circuit should be defined as an undetectable failure. However, because the circuit will be tested periodically in accordance with NRC Regulatory Guide 1.22, a failure such as postulated in the IDI Report should be considered a detectable failure under IEEE Std. 379-1977. Thus, the design of the circuit does meet the single failure criterion for protection systems.

In addition, NRC Regulatory Guide 1.47 describes an acceptable method of complying with the provisions of IEEE Std. 279-1971 with regard to indicating the inoperable status of a portion of the protection system. Automatic indication is not recommended where the inoperable status is not expected to occur more frequently than once per year, or where the inoperable condition is not expected to occur when the system is normally required to be operable. Neither condition is applicable to the control circuit in question here.

Nonetheless, in response to this item, a power monitor has bean added to the control circuit design to provide consistency of the design approach. This monitor will provide automatic indication of a loss of power in the circuit. No further action in response to this item is required.

05.4-1 (Observation) Division 3 DC System

Summary of Item

This observation states that there is a discrepancy among General Electric and G/C documents which describe the Division 3 DC System. The observation also states that there should be permanent physical protection between the battery and other electrical equipment in the Division 3 switchgear room.

Response

The first concern relates to a document discrepancy between a GE Topical Report and a related GE vendor drawing. The Topical Report describes general design features for the High Pressure Core Spray (HPCS) power supply in GE designed plants. GE Topical Reports are not intended to represent final plant specific designs. The vendor drawing was specific to the Perry Plant. This drawing indicated a charger size that was larger (more conservative) than that specified in the Topical Report. The battery charger size shown on the drawing is correct, and reflects the installed equipment at the plant. In addition, the observation acknowledges that the applicable G/C drawing was "based on the latest information supplied from General Electric." The G/C drawing is consistent with the vendor drawing and shows the correct battery charger size. While it would have been more precise to have referenced the vendor drawing, rather than the Topical Report, in our response to RAI 430.103, we do not believe that there is a discrepancy requiring any revision.

On the second item, the observation acknowledges that IEEE Std. 484 does not require installation of the battery in a separate room. The HPCS switchgear room is a controlled access area containing only HPCS electrical equipment, and there is no concern about damage to the battery from other equipment in the room.

For these reasons, no modifications or additional analyses are required.

05.6-1 (Observation) Motor Service Factor

Summary of Item

This item states that long time overcurrent protection for motors does not take motor service factor into consideration.

Response

As noted in this item, the Perry Project has no criteria or FSAR commitment to consider motor service factor in determining long time overcurrent protection of motors. Long time overcurrent protection for motors is based solely on the full load current rating of the motor. This protection is applied to promote continued operation of Class 1E motors under accident conditions.

An additional step in assuring the adequacy of motor protection is accomplished during start-up testing. Any field measured motor current in excess of the full load current rating noted during testing is reported to engineering. The measured value is evaluated to determine acceptability of the motor and motor protection.

No additional analysis or hardware modifications are required in response to this item.

05.6-2 (Observation) Battery Charger Feeder Breaker

Summary of Item

This item states that a battery charger feeder breaker is not properly coordinated with the internal charger protective device.

Response

The feeder breaker was not intended to be coordinated with the internal battery charger protective device. The primary purpose of the battery charger circuit breaker is to function as an isolation switch for maintenance. The charger breaker is sized properly for this application. The unit substation feeder breaker overcurrent relay provides the principal protection for the battery charger. As the indicated in the basis, there are no criteria that prohibit two breakers feeding a single load from both responding to an overcurrent condition at the same time.

Based on the above, no hardware changes or further analysis are required in response to this item.

05.14-1 (Observation) DC Undervoltage Alarms

Summary of Item

The observation states that the undervoltage relays for the battery charger and the DC bus are set at the same voltage value, and that the charger relay should be set higher than the bus alarm to alert the operator before a total charger failure occurs.

Response

Although there are no specific requirements governing alarm settings, we agree that a preferred design in this case is to set the charger relay higher than the bus relay. The 120-VDC setting selected for the battery charger is appropriate because it provides sufficient time to alert the operator to connect the spare battery charger to the bus. In response to this item, we will revise the setpoint on the DC bus undervoltage alarm to lower the setting. This setting will be changed by March 1, 1985. No hardware changes or further analysis are required in response to this item.

05.14-2 (Observation) 480 Volt AC Bus Undervoltage Alarms

Summary of Item

The observation states that the undervoltage relays on the 480-V unit substation buses are set at a level that may result in nuisance alarms.

Response

As noted in this item, these undervoltage relays provide a back-up alarm and are not a licensing commitment. We acknowledge that our load flow study indicates that "under certain conditions" bus voltage could drop below the 80% alarm setpoint during motor starting. However, this load flow study is based on worst case voltage conditions of the CEI system. These conditions will rarely occur, and for this reason we believe any resulting alarms will not hinder the plant operating staff. No hardware changes or further analysis is required in response to this item.

3.5 INSTRUMENTATION AND CONTROL

Set forth below are our item-by-item responses to the Instrumentation and Control Deficiencies, Unresolved Items, and Observations identified in the IDI Report. The number and title of each item are taken directly from the IDI Report.

D6.1-1 (Deficiency) ESWS Pump Forebay Level Instrumentation

Summary of Item

This item concerns the listing of instrument P45-R240 twice in the instrument index.

Response

This item identifies the duplication of an entry in the instrument index. The instrument index is a reference document controlled by the Control Systems Project Engineer (PE) and provides cross references to controlled sources of design input. The index is updated as directed by the PE, and discrepancies such as the keypunch error discussed here are marked up as input to the next revision of the index.

In this specific case, the revision had been issued two days prior to the IDI cut-off date and had not yet been checked. The index has been revised to eliminate the second reference to instrument P45-R240.

We agree with the IDI Report that this item is random and has no impact on hardware or analysis.

D6.1-2 (Deficiency) Safety-Related Instrument Loop Components Shown As Nonsafety-Related on Both Design Documents and Design Information Documents

Summary of Item

This item states that certain panel components on the Emergency Service Water System elementary wiring diagrams are indicated as safety-related, while the G/C instrument index and the GE device list classify these components as nonsafety-related or do not list them at all. This item further indicates that, due to the above situation, these devices have not been included in GE's Seismic Qualification Review Team (SQRT) package for the Power Generation Control Complex (PGCC) panels.

Response

The PGCC panels fabricated under specification SP-591 are known as Balance of Plant (BOP) panels. These BOP panels were built by GE to a "design freeze" revision of the elementary diagrams and shipped to the Perry site for installation. Any changes to elementary diagrams after the "design freeze" revision were made with an Engineering Change Notice (ECN), in accordance with the Perry Procedures Manual, Section 3.21 and Appendix N. The physical panel changes are made at the Perry site by the appropriate electrical contractor. The components listed in this IDI item were added to the panels prior to the IDI by ECNs 245L-033-01 and 245H-033-01 to upgrade certain instrument loops to safety-related as required by Regulatory Guide 1.97.

GE is responsible for qualification of only the devices that they supplied in the "as-shipped" configuration of the BOP panels. Qualification of these GE devices is documented in GE's PGCC SQRT Report. Components added by Engineering Change Notices to BOP panels are covered by the G/C Equipment Qualification Program. As part of the Equipment Qualification Program, components added by Engineering Change Notices are qualified by justifications, which are filed as a supplement to the GE PGCC seismic qualification packages. Therefore, it is not necessary to provide the ECN justifications to the vendor of the as-shipped panels.

In response to this item, the components designated on the G/C instrument index as "nonsafety" at the time of the IDI have been revised to "Div.-Safety". The Signal Resistor Units and DC Power Supplies, identified in the IDI Report as "not listed," have not been included because they are not instruments. Such components need not be listed in the instrument index. It should be noted that the instrument index is issued for information only, not for design. The index is periodically updated; however, the fact that it is not revised immediately to incorporate references to design changes does not in our view constitute a violation of Perry Procedures Manual, Section 2:03.8, which simply states that instrument lists are to be developed.

Concerning the GE device list, although the component classification was not physically changed on the list, the ECN numbers for the PGCC panels were posted on the controlled copies of the device lists located on-site, providing the required traceability.

This item does not have any hardware impact. Further, we do not believe that this item requires reanalysis of the seismic qualification of the PGCC panels, since the qualification documentation correctly reflects the current design. No further action is required.

D6.1-3 (Deficiency) Panel Number Identification on Drawings

Summary of Item

This item states that certain instrument panel numbers were either omitted from the elementary wiring diagrams or labeled inconsistently on the elementary wiring diagrams and the instrument index. The item states that the omissions and inconsistencies constitute a violation of a checklist contained in a G/C Engineering Design Guide.

Response

Guidance on formatting elementary wiring diagrams is contained in a G/C Engineering Design Guide. The Engineering Design Guide is not a formal procedure and is not referenced in any licensing commitments. The Engineering Design Guide recommends that the physical location of components be noted on the elementary diagrams. This practice facilitates use of the elementary diagrams. If a panel number were missing from an elementary diagram for any reason, the location could still be obtained using other controlled sources of design information. The elementary diagrams are not used for installation of equipment. As noted in our response to item D6.1-2, the instrument index is issued for information only, not for design.

In response to this item, each of the specific examples cited in the item has been reviewed. In each case where there was a panel number discrepancy between an elementary diagram and the instrument index, the elementary diagram was found to be correct. For those cases where no panel number is shown on the diagram and the instrument index indicates "Local," this correctly reflects the fact that only those devices contained in a panel or rack will be shown on the elementary diagram with a panel number. All other cases, as stated above, do not require references to locations because the information may be obtained from other controlled design documents.

This item has no hardware or analysis impact. Discrepancies found on the instrument index have been corrected. In addition, all miscellaneous drafting, typographical and omission errors observed prior to the IDI Report have been identified for incorporation into later drawing revisions. No other action is required.

D6.1-4 (Deficiency) Component Numbering Inconsistencies on Drawings

Summary of Item

This item states that a checklist in a G/C Engineering Design Guide was not used in preparing the elementary diagrams and that this resulted in omissions and inconsistencies in the elementary wiring diagrams.

Response

It is correct that the Engineering Design Guide checklist was not used systematically for all elementary diagrams covered by this item. The checklist provides general guidance on formatting elementary wiring diagrams to facilitate the initial preparation of the elementary diagrams. As noted in our response to D6.1-3, the Engineering Design Guide does not contain formal requirements. Further, the elementary diagrams are not used to control installation of equipment; therefore, discrepancies and inconsistencies on diagrams do not affect the adequacy of the installation.

In response to this item, we have reviewed the elementary diagram inconsistencies identified in the IDI Report. The inconsistencies concerning lack of termination numbers noted in the IDI Report had been addressed prior to the IDI in Engineering Change Notices. Each of the other inconsistencies identified in this item, along with other inconsistencies observed prior to the IDI, have been identified for incorporation into later drawing revisions. Our review confirms that the inconsistencies do not affect the design of the Emergency Service Water System. No additional action is required.

D6.1-5 (Deficiency) Instrument Setpoint or Contact Operation Not Specified

Summary of Item

This item states that instrument data sheets in two nonsafety-related specifications omitted required setpoint information and, in one case, specified an incorrect temperature range.

Response

As stated in the IDI Report, approximately 200 data sheets for 28 purchase specifications were reviewed during the IDI. These specifications were for both safety-related and nonsafety-related instruments. Only two specifications, SP-410 (nonsafety-related level switches) and SP-411 (nonsafety-related temperature switches), were stated to omit information or contain incorrect information.

With respect to SP-410, Engineering Instructions 1 and 9 do not require the inclusion of setpoint values in the procurement specification. SP-410 procured float and displacer-type level switches, which typically have a fixed actuation point established by the vendor relative to a reference point on the device. A plant-specific setpoint on the data sheet which references a plant or vessel datum is of no use to the vendor. The specific installation drawings and other supporting documents establish the working setpoint for each instrument. Data sheet 41 did specify a length for the displacer cable, and the actual field setting for the device is contained on the level setting diagram and setpoint list. For these reasons, the omission of setpoints in SP-410 was not a violation of either procedures or design requirements.

With respect to SP-411, data sheet 9 did not indicate that the contact on the temperature switch is required to operate on either increasing or decreasing temperature, but did indicate the contact type for the temperature switch as single-pole-double-throw. This type of switch has the capability for operating on either increasing or decreasing temperature. Thus, no additional information was required. It is further noted that the functions of the control loop containing the switch were properly noted on the logic diagram and correctly implemented on the elementary diagram.

The second concern having to do with SP-411 involved an apparent discrepancy between the temperature range and the maximum service temperature of the switch. In response to this item, it has been confirmed that the maximum service temperature of 300°F as indicated on the data sheet was too high (200°F is the correct temperature) and the indicated instrument range is correct. The instrument as specified is acceptable and had been successfully applied in the chemical cleaning of the process piping. No document or hardware changes are deemed necessary.

We agree with the IDI Report that no systematic problem exists with respect to information contained in purchase specification instrument data sheets, and that design control of these documents is a positive element of the program (see IDI Report Page 1-8). Further, the issues raised in this item involve only nonsafety-related hardware. No further action is required.

D6.1-6 (Deficiency) Instrument Power Source Drawing Errors

Summary of Item

This item states that there was a failure to follow the elementary diagram checklist in the G/C Engineering Design Guide, in that power source references contained in note 4 of the elementary wiring diagram's tabulation were not identified by an Engineering Change Notice as needing revision, and an incorrect system diagram number is listed on one diagram.

Response

This item correctly notes that there were two inconsistencies on elementary wiring diagrams. As noted in previous responses, the Engineering Design Guide does not contain formal requirements, but is merely guidance for preparing elementary diagrams. Further, the elementary diagrams are not used to control the installation of equipment; therefore, discrepancies and inconsistencies on the diagrams do not affect the adequacy of the installation.

In response to this item, the discrepancies noted in the IDI Report have been corrected by issuing an ECN to the applicable diagrams. These discrepancies are random occurrences and minor in nature, and have no impact on design. No further action is required.

D6.1-7 (Deficiency) Electrical Schematic Design Verification

Summary of Item

This item states that there is no documented evidence that the verifier of elementary wiring diagram B-208-222, Sheet 370, considered the separation list as design input during verification.

Response

G/C Electrical Department Procedure 0421-1.5, which governs verification of elementary diagrams, required the verifier to list design input documents used during verification of elementary diagrams. In this case the separation list was a design input and should have been identified as a design input.

As explained in response to item D6.2-2, a preliminary analysis demonstrates that separation criteria were not violated in the design of the circuits in question. This analysis will be finalized and referenced in the design verification documentation package for the elementary diagram by February 15, 1985.

Only one potential separation problem was identified out of hundreds of elementary diagrams reviewed during the IDI. We agree that the extent of this item is limited to the identified deficiency, which has been corrected. No further action is required on this item.

D6.1-8 (Deficiency) Unissued Engineering Change Notice Referenced in Drawing Revision Block

Summary of Item

This item states that a G/C elementary diagram referenced an Engineering Change Notice (ECN) in the drawing revision block, and that the ECN was never issued.

Response

Series 245 ECNs for G/C-designed and GE-fabricated control panels are prepared by G/C and issued to the contractor for the purpose of incorporating design changes made after the GE design freeze cutoff date of May, 1977. In this case GE agreed to incorporate the design changes itself after the design freeze cutoff date, and therefore, no ECN was required.

In response to this item, the ECN (and other unissued Series 245 ECNs) will be issued for design traceability and record-keeping purposes and added to the ECN status logbook by March 15, 1985. This item has no hardware or analysis impact. No further action is required.

D6.1-9 (Deficiency) Logic Diagrams Are Not Being Updated By The Engineering Change Notice Process

Summary of Item

This item states that two Engineering Change Notices (ECNs) were written to elementary diagrams which did not indicate a corresponding change to the logic diagrams.

Response

Logic diagrams which show how a system functions were prepared as inputs to the initial preparation of elementary diagrams. Many ECNs written to modify elementary diagrams do not affect system functions. In some cases, ECNs written to modify elementary diagrams were issued to agree with the logic diagram. In these cases no change to the logic diagram was necessary. This was the case with ECN 10585-86-196, cited in this item. In a few cases, as in ECN 13137-86-219, Rev. B, also cited in this item, a change to the logic diagram should have been made.

The Perry Procedures Manual will be revised to require that all elementary diagrams be verified. This will assure that the elementary diagrams and ECNs to elementary diagrams will contain all design functions. Therefore, the logics do not need to be revised. The procedure revision will be made by February 15, 1985. No hardware changes or analyses are called for by this item. No further action is required.

D6.1-10 (Deficiency) Elementary Wiring Drawing Sheet Not Updated During Incorporation of an Engineering Change Notice

Summary of Item

This item states that an Engineering Change Notice (ECN) was prepared to correct four sheets of the Emergency Service Water System elementary wiring diagrams. Three months later the ECN was incorporated on three of the sheets, but not on the fourth sheet.

Response

As noted in the IDI Report, the design change addressed in this item required that four elementary diagram sheets be revised. Three of the affected sheets were listed on ECN 245L-033-01, which is referenced in the item. Because of the allocation of work between contractors for this particular design change, the other affected elementary diagram sheet was identified on another ECN, ECN 16139-86-267. (This ECN was not referenced in the item.) Thus, the design change in question was fully implemented in accordance with the G/C Design Control Program. No hardware, analysis, or documentation changes are required for this item.

D6.2-1 (Deficiency) Failure to Meet the Single Failure Criterion For Loss Of Off-Site Power From Loss of Divisional Bus Sensors

Summary of Item

This item states that there was a failure to meet the single failure criterion in the development of LOOP (loss of off-site power) signals used to start safety-related equipment.

Response

We agree that the LOOP signals did not meet the single failure criterion in the case of the postulated loss of the Unit 1 Division 1 or Division 2 battery. In response to the item, we performed an analysis which demonstrated that the dependence of redundant LOOP signals on both Division 1 and Division 2 battery sources would only have affected the control complex ventilation systems. Further, it would only have affected the ability of these systems to start automatically on a LOOP. The design also provided for manual control.

In response to this item, G/C has revised the design of the LOOP signals to assure that a single failure will not prevent automatic restart of the control complex ventilation systems on loss of off-site power. Based on our extensive design reviews and the review by the IDI team, we believe that this is a random design occurrence. No further action is required.

D6.2-2 (Deficiency) Main Steam Line Leak Detection Circuit Separation

Summary of Item

This item states that physical separation requirements in redundant electrical circuits for main steam line leak detection annunciators were not satisfied.

Response

We agree that consideration of separation requirements should have been documented in the design of the two control room panels addressed in this item. In response to this item, a preliminary analysis has been performed which demonstrates that postulated faults in the circuits cannot result in a defeat of the trip function. This preliminary analysis confirms that the system as wired is acceptable and meets all design requirements. The analysis will be finalized and verified by February 15, 1985. Given the results of the analysis to date it appears likely that the designer adequately considered separation requirements, but failed to document his assessment. Hardware modifications to the circuits are not anticipated.

D6.2-3 (Deficiency) Incomplete Separation List Drawing

Summary of Item

This item states that limit switches on valves in the Emergency Service Water and Emergency Closed Cooling Water Systems should be listed as sensors on the G/C separation list.

Response

Motor-operated valves such as those covered by this item do not need to be listed as sensors on the G/C separation list. The G/C separation list is a tabulation of redundant components which identifies separation groupings to meet the design requirements of the single failure criterion. Motor-operated valves, including their accessories, are identified on the separation list as assemblies covered by the valve tag number. The instruction referenced in this item defines certain guidelines to be followed in entering items on to the separation list and identifies "sensors" as items to be entered; however, motor-operated valve limit switches are not considered as "sensors" separate from the valve motor operator assembly for purposes of the separation list. As noted in the IDI Report, the elementary diagrams correctly depict separation requirements for the valve limit switches identified in this item.

In response to the item, G/C has reviewed a number of other elementary diagrams and has confirmed that separation requirements were correctly implemented for motor-operated valve limit switches. The project instruction will be revised to clarify that valve limit switches need not be listed on the separation list. This revision will be accomplished by February 1, 1985. No further action is required.

D6.2-4 (Deficiency) Instrument Rack Separation List

Summary of Item

This item states that six safety-related local instrument racks were omitted from the separation list.

Response

We concur that some racks were not identified on the rack separation list. However, the instruments installed on these racks were correctly identified on the instrument separation list. This instrument separation list classification is sufficient to develop the detailed design to meet single failure requirements, including rack assignments.

In response to this item, we performed a review to assure that all racks are properly identified on the rack separation list. The rack separation list is in the process of being updated to include all missing racks. In addition, the separation list instruction will be revised to specify that any new instrument racks be identified on the rack separation list. Corrective action for this item will be complete by March 1, 1985. No further action is required.

D6.3-1 (Deficiency) Lack of Documentation of Setpoint Calculations and Lack of Control of Setpoint Data and Support Data

Summary

This item states that there was a lack of documentation, and inadequate control of the documentation, for vendor setpoints, setpoint calculations, and setpoint tolerances.

Response

CEI has committed to Regulatory Guide 1.105, "Instrument Setpoints," Rev. 1 (November 1976) for ensuring that protective instrument setpoints do not fall outside the limits specified in the technical specifications. Regulatory Guide 1.105 provides guidance on how to achieve adequate margin in establishing setpoints to account for such factors as instrument accuracies, calibration errors and instrument drift. The Regulatory Guide does not state that calculations are required.

Setpoints are established by the responsible designer and incorporated in a source document package and Setpoint List as follows:

Nuclear Steam Supply System (NSSS) - General Electric Company
Balance of Plant Systems (BOP) - Gilbert/Commonwealth, Inc.
Skid Mounted Equipment - Equipment Suppliers.

NSSS setpoints and criteria are documented in GE design specifications and recorded on the Setpoint List.

BOP safety-related setpoints are calculated, verified, and then recorded on the source document package and Setpoint List. The source of safety limit data is always referenced in the calculation.

Vendor setpoints are documented either on drawings, instruction manuals, or correspondence, and then recorded on the source document package and Setpoint List.

In the case of the standby diesel generators, the IDI Report states that only six instrument setpoint calculations are documented out of 52 instruments which perform a safety-related function. We do not agree that all of the 52 instruments referenced in the report perform a safety-related function. The only instruments (of the 52) which perform a safety-related function are the fuel oil day tank level controls. As noted in this item, setpoints and calculations for these instruments are on file at G/C.

This item also states that no setpoints or setpoint calculations exist for safety-related shutdowns or control functions for the Carrier Corporation chiller units. The Carrier chiller units are vendor supplied. At the time of the IDI, vendor documentation had not yet been reviewed to identify setpoints for the units. At completion of the review, the setpoints will be identified and entered on the Setpoint List. The list will be updated by February 15, 1985.

The IDI Report also noted that setpoint documentation did not provide tolerance values needed for instrument calibration and development of test acceptance criteria, and that there was no review of the effects of setpoint tolerances on safety limits. At the time of the IDI, a program had been initiated to revise setpoint calculations to include tolerances and to add tolerances to the Setpoint List. This program assures that the effects of setpoint tolerances on safety limits are addressed. For the specific example mentioned in this item, the P47N261 A/B level switches, the calculation has been redone to incorporate tolerances and the setpoint has been modified to reflect the revised calculation.

Finally, the Setpoint List has now been designated as a controlled document under project procedures. No additional corrective action is required to respond to this item.

D6.4-2 (Deficiency) Inadequate Electrical Equipment Qualification of the Hydrogen Analyzer Cabinet

Summary of Item

This item states that the qualified life of the organic components of the hydrogen analyzer cabinet is less than the 40-year qualified life of the cabinet.

Response

We agree that there were components in the hydrogen analyzer cabinet with a qualified life less than the qualified life of the cabinet. However, the Equipment Qualification Review List specifies maintenance and component replacement schedules which assure replacement as required of components with qualified life less than 40 years. Thus, the Equipment Qualification List is designed to assure that the 40-year qualified life of the cabinet will be achieved.

The qualified life of the hydrogen analyzer as a system is established in a Comsip Delphi, Inc. letter dated April 14, 1982. This letter, which was included in the qualification documentation package, states that the qualified life of the hydrogen analyzer system is 40 years, provided that maintenance and the replacement program recommended by Comsip Delphi is observed. That program is included in the instruction manual that was formally submitted by the vendor, and in the vendor document titled "K-III/K-IV Qualification Plan and Results," which was included in the package. The components with qualified life less than 40 years will be replaced within their qualified lives, thus assuring the 40-year life of the cabinet as a whole. The information that exists in the qualification document package provides sufficient justification of the hydrogen analyzer system's 40-year qualified life, consistent with ANSI N45.2.11. For these reasons, no further analyses and no hardware modifications are required in response to this item.

D6.5-1 (Deficiency) Concurrent Failure of Unqualified Instrumentation

Summary of Item

This item states that no formal analysis was documented to demonstrate that the use of non-seismically qualified instruments in the Emergency Service Water System would not result in performance degradation due to concurrent failure of all non-seismic instruments. The item also states that the deficiency could exist in other open-loop systems.

Response

As noted in this item, 28 instruments in the Emergency Service Water System were classified as nonsafety-related and were not seismically qualified. Instruments and their interconnecting impulse tubing lines were classified in accordance with industry criteria ANS-22 (May 1973) and GE MPLA62-1010 and A62-4030(22A5495). An evaluation was performed in 1980 to ensure that classifications of instrument installations were consistent with these criteria.

In response to this item, a formal analysis was performed, which confirmed the validity of these classifications. Sixteen of the 28 non-seismic instruments in the three loops of the open loop ESW system are test instruments with normally closed, seismically qualified root valves. Some of the remaining 12 instruments require dual sensing lines, with the net result that only three impulse lines per loop, or nine total, are non-seismic. The analysis demonstrates no degradation of the fluid system or surrounding safety equipment from spray or flooding caused by concurrent failures of all non-seismic impulse lines of this system. The Emergency Service Water System system is the only safety-related open loop system. For these reasons, no further analysis of systems and no hardware modifications are required in response to this item.

D6.5-2 (Deficiency) Safety-Class Readout Indicators Supplied from Nonsafety Instrument Transmitter Loops

Summary of Item

This item identifies the use of safety-class control room readout instruments in nonsafety applications and postulates that the plant operator could be misled regarding the quality and validity of readouts from these instruments.

Response

Certain readout instruments which perform a nonsafety function were procured as safety-related although they receive signals from nonsafety sensors. These instruments are located on control room boards along with safety-related instruments which receive signals from safety-related sensors. Although not required, this higher than necessary qualification provides added protection to the adjacent safety-related instruments, which otherwise might be endangered by failure of non-qualified instruments during a seismic event. No regulatory requirements or guidance exist which prohibit use of components processed as safety-related to perform nonsafety functions.

The fact that the readout instruments were procured as safety-related will not lead to operator confusion regarding validity of the readouts. In order for operators to properly identify important safety readout instrumentation, all readout instruments with a safety function display their divisional assignment on their faceplate. In addition, post-accident monitoring instruments required to meet Regulatory Guide 1.97 will be clearly identified as "post-accident instruments" on their nameplates. The readout instruments in question will bear neither of these type makings. Operator training and operating procedures assure that information is obtained from the proper readout instruments.

No hardware or reanalysis is required by this item. For the reasons stated above, we do not believe that any additional documentation changes are necessary.

D6.5-3 (Deficiency) Safety Class 3 Designation Inconsistencies

Summary of Item

· This item states that both safety and nonsafety type instruments exist in the safety-related Emergency Service Water System pump loop, and that the impact of this mixed classification has not been analyzed.

Response

The Emergency Service Water System instruments supplied by the strainer vendor are nonsafety; however, this is not considered to be a violation of the strainer specification SP-522 requirement for ASME III Code attachments since instruments are excluded from the Code by Paragraph NA1130C.

We do not believe that Appendix U of the Perry Project Procedures Manual was violated by the mixed safety classification addressed in this item. Appendix U contains only general classification criteria. In implementing this criteria, G/C considered the guidelines in draft standard ANS-22. Under this standard, instruments with no safety function may be nonsafety class if installed downstream of the root valve. All of the devices identified in this item, including those procured as safety-related, are installed downstream of the root valve. Some of the devices in this system were procured as safety-related because the design process and equipment procurement were in progress while the instrument classification guidelines were being developed and were thus done conservatively. Once the classification guidelines were in place, there was no reason to replace instruments which had been purchased to a higher than required quality level.

Failure of these strainer pressure instruments was considered in the formal analysis discussed in our response to item D6.5-1, and was determined not to result in degradation of the Emergency Service Water system or surrounding safety-related equipment. No other action is required in response to this item.

D6.6-1 (Deficiency) Inadequate Calculation Verifying the Scram Discharge Volume Scram Setpoint and Rod Block Setpoint

Summary of Item

This item states that there were inadequacies in the preparation of the scram discharge volume piping Calculation C11-C05.

Response

Calculation C11-C05 was deficient is some respects. However, a recalculation has confirmed the adequacy of the original results.

As noted in the IDI Report, Calculation C11-C05 was performed to establish safety limits only for scram discharge volume level instruments. Calculation C11-C05 is not covered by Regulatory Guide 1.105, because it does not establish margins for setpoints. Rather, it converts GE volumetric requirements into level settings. The basis for these safety limits has always been shown on the Control Rod Drive Hydraulic System diagram (GE Dwg. 767E673AA), which has been prepared, verified, and distributed in accordance with ANSI N45.2.11. The actual setpoint calculations for these instruments were performed in Calculations C11-C01, C11-C02, and C11-C03 in accordance with Regulatory Guide 1.105.

While Calculation C11-C05 was a comparatively straightforward computation involving simple addition, it nonetheless should have been formalized and added to the calculation log for setpoints. The completion of Calculation C11-C05 had been identified prior to the IDI as a work item to be completed, and the possible impact on the other calculations was recognized. In response to this item, Calculation C11-C05 has been formalized and added to the Log. The verification of Calculation C11-C05 will be completed by February 15, 1985.

We agree that the reference to unverified Calculation C11-C05 in Calculations C11-C01, C11-C02, and C11-C03 should have been identified in these calculations as an input requiring later confirmation. In response to this item, Calculations C11-C01, C11-C02, and C11-C03 were reanalyzed, and in one instance a minor documentation correction was noted.

The item also indicated that there should be a Mechanical discipline calculation to ensure that the volume of piping above the scram setpoint is sufficient to accommodate one scram. As discussed in our response to item U6.6-1, the calculation for the piping volume in the scram discharge header has been formalized in Mechanical Calculation C11-6 to ensure that the piping meets GE requirements. This calculation confirms that the scram discharge volume is sufficient.

In light of the above corrective actions, no further action on this item is required.

D6.6-2 (Deficiency) Design Assumptions Used in Calculating the Scram Discharge Volume Scram and Rod Block Setpoints Are Not Documented

Summary of Item

This item questions the temperatures used in calculating scram discharge volume level setpoints. The item further states that the instrument locations in these calculations are inconsistent with as-built conditions.

Response

With respect to the temperatures used in calculations, the scram discharge volume setpoint Calculations C11-C01 and C11-C02 for level transmitters were performed considering temperature along with other environmental factors in accordance with Regulatory Guide 1.105. As noted in the IDI Report, ambient air temperatures of 62° to 104°F were used in the calculation. The basis for using these temperatures was that, although higher fluid temperatures than ambient are possible in the scram discharge volume, the level transmitters for scram and rod block interlocks include filled capillary diaphrams to prevent process fluid contact with the instruments. The instruments, therefore, are not sensitive to fluid temperature variations, but only to ambient temperature as used in the analyses. The selection of this type of instrument thus precluded the need to consider higher than ambient temperatures.

With respect to the location of the level transmitter, the field location discussed in the IDI Report was actually one of two middle piping tap elevations, not an instrument elevation. These tap elevations were considered and referenced in Calculation C11-C03, since its instruments were connected to these middle taps. However, the instruments analyzed in C11-C01 and C11-C02 are differential pressure instruments, which are not connected to these middle taps. Therefore, the as-built field information was irrelevant to the calculations referenced in the IDI Report.

Because there was no undocumented assumption concerning temperature used in the scram discharge calculations, and because the setpoints are consistent with as-built conditions, no additional analysis or interface review is necessary.

D6.6-3 (Deficiency) Incorrect Location of Backup Scram Level Instruments for the Scram Discharge Volume

Summary of Item

This item states that there were inconsistencies between the as-designed and as-installed locations of the level switch settings for the scram discharge volume backup instruments, which caused the as-built level switch settings to be outside the operating range of the instruments.

Response

G/C was aware of the fact that the as-built location was, because of constructability obstacles, different from the as-designed location of the switches. G/C was in the process of reconciling the design with the as-installed condition consistent with G/C procedures at the time of the IDI review of this item.

As noted in the IDI Report, the nominal trip setpoint for the backup scram level switches as described in Calculation C11-C03 is 626'-9.75". Because the switches were mounted in a highly congested area, it was not possible to mount all four switches at the same elevation. Subsequent to the IDI, Calculation C11-C03 was revised to note the field adjustments to be made for the level switches at the time of calibration. This calculation confirms that the installed switches are within the range of the instruments. Accordingly, no further analysis and no hardware changes are required.

D6.7-1 (Deficiency) Equipment Qualification Review List Discrepancies

Summary of Item

This item states that incorrect information was found in the Equipment Qualification Review List with respect to the qualification status and qualified life of Rosemount transmitters.

Response

The first issue in this item relates to inconsistencies between the qualified life of the transmitters noted in the EQRL and the qualification package calculation for qualified life. The inconsistencies were due to keypunch operator error and do not impact the actual qualification of the components. The actual qualified life of the components is 10 years, as shown in the qualification package. This has been corrected in the EQRL.

The second issue in this item relates to the qualification status of Rosemount transmitters. Calculation 5.10.4.3, Rev. 2, dated May, 1984, with reduced radiation dose at the specific mounting location of these transmitters, was made available for inclusion in the qualification package shortly before the cut-off date of the IDI. Therefore, the EQRL, Status A, designation reflected the correct status for the environmental part of the qualification. The ongoing testing and analysis discussed in the IDI Report pertains only to the seismic portion of the qualification, which is correctly reflected by the Status C shown in the EQRL. Therefore, this was not an EQRL discrepancy.

The qualification of equipment is an ongoing process. As such, the EQRL is periodically reviewed and updated as status changes are known. Changes to the data base have always been approved prior to entry and checked after entry. Nonetheless, in response to this item, the EQRL change procedure and forms utilized for this effort have been formally incorporated in the Equipment Qualification Program Manual. In addition, the qualified life of all equipment in the EQRL will be reviewed by March 1, 1985 for transcription errors in completed data entries. This deficiency does not have any impact on installed hardware or qualification analysis.

D6.7-2 (Deficiency) Inadequate Calculation Contained in an Electrical Equipment Qualification Package

Summary of Item

This item states that an unverified calculation was included in the environmental qualification package for the WEED Model 611 temperature detectors.

Response

We agree that the calculation in question was not verified at the time of the IDI. This unverified calculation was done during the on-site environmental qualification audit performed by the NRC in early 1984. The calculation was performed to confirm the qualified life of the temperature detectors. No calculation had been made originally because the reviewer of the qualification report believed the qualified life was established by the vendor report. G/C intended to finalize the calculation made per the NRC request, although it was not completed by the time of the IDI.

In response to this item, G/C has formalized this calculation, Calculation 596 C84-01, and issued it for insertion in the permanent qualification record. The IDI review of a number of qualification packages uncovered no other instances of unverified calculations. No further action is required.

D6.7-3 (Deficiency) Seismic Qualification of Instrumentation Components in Balance-of-Plant Power Generation Control Complex Panels

Summary of Items

This item states that there is no documented evidence that some components of the P45 and P42 balance-of-plant systems are seismically qualified. It further states that the G/C Engineering Change Notice (ECN) qualification justifications may not adequately be addressing design modifications to assure that all required seismic analyses will be performed.

Response

We agree that a number of PGCC panel components were not addressed in the seismic analysis documentation packages, and have taken corrective action to qualify these components and to assure that similar errors will not recur. The corrective action discussed below indicates that there have been a relatively small number of errors and that the overall seismic qualification program for new components has been adequate.

In response to this item, we have reviewed all balance-of-plant (BOP) PGCC panel ECN qualification justifications completed to date, in order to verify that all added components were identified, and that qualification documentation was supplied for each component. Only a few cases other than those identified in this item were found where components were missing from the justification. Qualification documentation for all missing components will be updated by March 1, 1985.

In addition, the program for identifying components required to be qualified by ECN justifications has been strengthened. The list of components (device list) attached to the ECN will not be closed out on the ECN Status log until qualification documentation for each component has been provided and filed in the qualification documentation. We believe that this revised method for identifying components, and the other corrective actions described above, adequately address the concern identified in this IDI item. No further action is required.

D6.8-1 (Deficiency) Flexible Conduit Separation at Rack H51-P1124

Summary of Item

This item states that a safety-related flexible conduit and a nonsafety-related flexible conduit coming into local rack H51-P1124 are not tied down and could be brought into contact with each other during a seismic event.

Response

The flexible conduits addressed by this item are required for seismic isolation between the raceways and instruments. For this purpose, it is necessary to assure minimal transfer of dynamic loads during a seismic event. This is accomplished by allowing the movement of the conduits. The addition of spacers, as suggested in the IDI Report, could defeat this purpose.

We agree that the particular conduits in question, although maintaining the minimum one-inch separation in a static condition, can be manually positioned such that they are actually in contact with one another. However, we question whether this manual positioning accurately simulates a seismic event. Further, IEEE-384 (1974) prescribes a minimum separation of one inch between safety-related and nonsafety-related conduits in the installation of the conduits. The standard also states that separation should be provided to maintain the independence of a sufficient number of circuits and equipment so that the protective functions required during and following a Design Basis Event can be accomplished. The standard does not state that minimum separation distances for installation of flexible conduits must be maintained during a seismic event, as long as the required protective functions can be accomplished.

In the case noted in the IDI Report, even if the raceways came into contact during a seismic event, there would be no degradation in the function of the circuits for the following reasons: (1) the circuits are not related, nor are they associated with redundant safe-shutdown systems; (2) voltage levels in the circuits are less than 120 Volts (low level), and are instrument/analog in function; (3) cable insulation is rated at 600 Volts; (4) cable flame retardance parameters exceed IEEE-383 requirements; and (5) the cables are physically protected within independent flexible steel raceways. For these reasons, adequate separation to meet all design requirements is maintained between the conduits in question.

Based on the above, no hardware changes or other actions are required for this item.

D6.8-2 (Deficiency) Cable Separation Within Panel 1H13-P904B

Summary of Item

This item states that a Division 1 cable bundle in a control room panel is in contact with a barriered compartment containing Division 2 circuits, and that this violates separation criteria for redundant cables and wiring.

Response

We believe that the required separation criterion were met. IEEE-384 (1974), Section 5.6.2, permits separation between redundant divisions of safety-related cable in panels to be accomplished either by maintaining minimum separation distances or by installing barriers. As acknowledged in this item, barriers were installed between the redundant divisional cables. The G/C procurement specification, SP-617, referenced as the basis for this item, is applicable to the Reactor Remote Shutdown Panel and does not apply to control room panels. The applicable specification for this equipment is SP-591, which also contains the one-inch criteria referenced in this item. As noted in this item, the one-inch criteria relates to "components," and does not apply to wiring separation. As noted in this item, the governing requirement for wiring separation within panels is IEEE-384 and, as stated above, the barriers constitute compliance to the requirements.

Because the cable routing installation within the control room panel discussed in this item was performed in accordance with IEEE-384, no further action on this item is required.

O6.2-5 (Observation) Separation List Drawing Changed to Conform with Lower Tier Drawings

Summary of Item

This item expresses a concern that the G/C separation list was revised to agree with lower tier wiring drawings.

Response

We agree that the separation list is the higher tier document, and should not have been changed without a documented analysis. However, as stated in the response to item D6.2-2, an analysis confirms that no separation problem exists in the present wiring arrangement.

In response to this item, the instruction on the separation list will be revised by February 1, 1985 to emphasize that lower tier documents should not be utilized in revising the separation list without a documented analysis.