Docket File

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

July 29, 1991

Docket Nos. 50-315 and 50-316

Mr. Gene Fitzpatrick, Vice President
Indiana Michigan Power Company
c/o American Electric Power Service Corporation
1 Riverside Plaza
Columbus, Ohio 43216

SUBJECT: D.C. COOK - REQUEST FOR ADDITIONAL INFORMATION, FOLLOW-UP TO REACTOR PROTECTION SYSTEM MODIFICATION AUDIT (TAC NOS. 80119, 80120)

During the week of July 8-12, 1991, the NRC conducted the first portion of an audit/review of the ongoing DC Cook Reactor Protection System modification project. Prior to that week of audit, a topic/question list was forwarded to DC Cook outlining the review topics, the level of detail, and the scope of support information required to support the NRC review. During the audit week, it was discovered that much of the needed information was not yet available or was incomplete. As a result, the NRC audit team reviewed the topic/question lists, item by item, with both DC Cook and Combustion Engineering (CE) personnel. As part of that discussion, specific details of the NRC questions and specifics on the necessary information required to support the NRC review were outlined. There are three enclosures to this letter that summarize the topics and support information discussed with the DC Cook and CE personnel. The information needs which comprise the enclosures were identified to DC Cook personnel during the audit week of July 8.

Additionally, the NRC audit team explained the NRC audit concepts of a "thread" review (hardware) and a software "walkthrough" to DC Cook and CE personnel. They acknowledged an understanding of these concepts and the types of information and documentation necessary to support this audit technique. It is our intention to conduct the "thread" and "walkthrough" portion of the audit during August 5-7, 1991, at the Rockville CE office. DC Cook personnel verbally stated that the necessary information, and DC Cook personnel, CE personnel and Taylor personnel would be made available to support that portion of the audit when we scheduled it.

It is also our intention to review the remaining portions of the topics/question list either during the last week in September or the first week in October, depending on information availability. During that portion of the audit, we would expect the remaining support information and documentation and the remaining personnel to be available to facilitate a timely NRC review. Furthermore, we have discussed with DC Cook personnel that

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the potential exists that NRC concerns may arise during the remaining portions of the review that could potentially affect the NRC Safety Evaluation schedule.

If you have any questions, please contact me on (301) 492-1341.

Sincerely,

Original Signed By:

Timothy G. Colburn, Sr. Project Manager
Project Directorate III-1
Division of Reactor Project - III, IV, V
Office of Nuclear Reactor Regulation

Enclosures:
As stated

cc w/enclosures:
See next page

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ENCLOSURE 1

INFORMATION REQUIRED TO COMPLETE THE D.C. COOK RPS UPGRADE AUDIT

The following reports, analyses and documentation were identified to members of the DC Cook and CE audit support team at a July 11 meeting. The information is required to enable prompt and complete review of the safety concerns for the DC Cook RPS Upgrade. The following list provides, by subject topic, a brief description of the material and a reference to the previous Request for Additional Information (RAI) by section number (topic list provided prior to audit). The software documentation has been footnoted to clarify what information will be needed for the software "walkthrough."

AUDIT TOPIC / INFORMATION REQUIRED

1.0 BACKGROUND INFORMATION / CE Taylor info-FATS, service bulletins, trouble reports, maintenance requests-see also Audit Topic 2.7.

2.0 DESIGN BASIS / Origin of functional requirements such as constants (new and old) - see also Audit Topic 5.2.3.

Provide basis for qualification of the electrical isolation devices. Test data for input & output short circuits as well as maximum voltage shorts to both inputs and outputs to demonstrate no effects or equivalent compliance to IEEE 279-1971 Par. 4.7.2.

Seismic test data for conformance to IEEE 344, provide "retest" report and configuration document 98689-ICE-3425. Document the equipment to be qualified by substitution of test data.

Provide the Summary Qualification Report for equipment thermal qualification which includes the retest data analysis, resolves the present test anomalies and indicates the electrical load test margin for the power supplies when tested. Several of the equipment items are not rated for the internal cabinet temperatures as tested. Provide an analysis to describe these conditions and possible operational effects.

Provide the integrated FAT procedure to demonstrate the system response times compliance with the Licensee System Specification para. 5.8.9.

Provide the reliability specifications required by Licensee System Specification para. 5.8.9.

Provide the accuracy specification and data sheets required by Licensee System Specification para. 5.8.9, also portions to be available in the FAT procedure.

3.0 FAILURE MODES AND EFFECTS / Provide an analysis to compare the new and old instrument interfaces and compare their vulnerabilities to short circuits, over voltage connections, etc.

Provide analysis and/or tests to demonstrate protection from "digital type" failures such as lockup and timing hazards. Describe the detection and recovery schemes.

Demonstrate that the diversity and segmentation provided by the original design has been preserved in the allocation of functions to the modules.

Provide an analysis to demonstrate that the system failure modes such as transient frequency and severity are no worse than the original design.

4.0 EFFECTS OF NEW EQUIPMENT TO EXISTING EQUIPMENT / Provide ESD test reports to identify compatibility of the ESD equipment ratings with the Licensee System Specification and the plant control room humidity limits. Provide a justification for the lack of emission testing in a cabinet not qualified to current EMI requirements. Verify no interactions between the 130 or more microprocessors added by this system and others such as the control system. Describe EMI test anomalies in terms of cause and effects. Provide a brief analysis of the application of MIL-Std-461 (per system Specification) and the test limits identified which do not include the plant transceivers operating at 450 MHz. Describe the test to identify the EMI levels at the RPS equipment from the operation of any plant equipment with RF emissions.

Provide the plant vital power quality data for surges, harmonic distortion, spikes and sags.

Provide a description of the vendor grounding requirements as stated in the Licensee System Specification para. 5.7.15 and describe how the plant grounding system designed for low frequency single point application will be adapted for a system with high frequencies (2MHz or more) contained within the cabinets.

5.0* Software Assessment / Provide the operational history of the Taylor software to include such items as: what problems were encountered during field integration testing; how were they reported; how were they resolved; how are the problems categorized; etc.

Reliability and MTBF figures need to be provided for the software modules used in DC Cook upgrade system.

Provide data on the total user base for the MOD 30 line of equipment, organized by industry and application areas.

* Provide test reports on the "fast response" Math Module, including such items as: what problems were encountered during integration testing; how were they resolved; and how are the problems categorized.

*Support information and documentation for this topic will be needed August 5-7, 1991, to the support software walkthrough.

Provide the list of Software modules which make up the firmware on the MOD 30 units used in DC cook upgrade system.

* Provide the following information about Taylor provided equipment:
1) Description of the structure of the executive of the Math module.
2) Description of how memory is organized.
3) Description of timing in the Fast Math Module.
(note: These topics were specifically addressed in a telephone conversation on July 10, 1991, between Taylor, CE, AEP, and the NRC. The minutes of the conversation will be prepared by CENP and Taylor and submitted to the NRC.)

* Based on a list of external data elements (such as configuration definition, analog input, equation constant, etc) selected by the NRC, provide a trace of these data elements through execution of the program in the Math Module. Show how data accuracy and precision is maintained through all the stages of data transformation in terms of internal representations, bytes of storage, scaling factors, etc. (See Enclosure 2)

* Provide a trace of the software execution or the Math Module from input to output, looking at all phases of how the process signal is acquired, transformed, displayed, output, etc. Provide listings of the necessary pseudo code and the assistance of a knowledgeable Taylor person to enable this trace to be conducted.

Provide a copy of the vendor V & V plan for the DC Cook upgrade system (CE document ICE-QP-861932 - 01 rev. 00).

Provide a software configuration control plan for the firmware configurations as well as the PC30 configurator software modified by CE. This plan should also address how the PC30 software is to be tested and accepted for use by CE/AEP.

Provide data for the MOD30 modules to be tested (before or during FAT) to verify cycle execution times over the entire range of expected inputs and loop operation? This is especially important for the Fast Math module.

Provide the procedures for controlling the configuration of the PC30 software at DC Cook, to include the AEP general policy statement on control of software products as well as specific restrictions to be placed on the use of the PC30 configurator.

Provide the procedures for controlling the use of the PC30 configurator at DC Cook to modify or maintain the firmware configurations to the MOD 30 instrument modules.

* Support information and documentation for this topic will be needed August 5-7, 1991 to support the software walkthrough.

* Provide a copy of the CENP audit report on Taylor software development procedures when completed. (If available by August 5-7).

* Provide a copy of the Taylor "MOD 30 Level 2 System Functional Test Plan" dated 10/11/83.

* Provide in detail the Taylor Engineering Test Lab reports applicable to the MOD 30 modules used in the DC Cook project.

* Provide information on what problems were encountered during software development: how they were discovered, how they were corrected and tested.

  Provide information on what software problems were encountered during field installation: how they were discovered, how they were corrected and tested.

  Verify that the Taylor document "Methodology for Testing Software" was followed in development of the PC30 software, and provide documentation of the testing results.

  Determine if the Taylor "PC-30 Test Plan" dated 10/11/88 is applicable to the software used as the basis for PC-based MOD 30 configuration software modified by CE, and show how this becomes the basis for testing of the modified PC-30 software.

  Provide documentation of the execution of the V & V on the DC Cook upgrade in accordance with the CENP V & V Plan for DC Cook.

6.0 MISCELLANEOUS ITEMS / Provide the table of connections to the 120Vac power per the Licensee System Specification. Inrush, etc. may be provided by the FAT.

Provide an analysis demonstrating that the addition of 130+ Li batteries does not present a hazard in the control room. Address the effects of faults, charges/discharges and other failure modes that may result in damage. Identify protective features to be provided.

Describe on site ESD tests planned.

Provide plant LERs, NCRs and significant MWRs pertinent to the instrument power system.

Identify the use and control of the configurator and PC.

* Support information and documentation for this topic will be needed August 5-7, 1991, to support the software walkthrough.

ENCLOSURE 2

DC COOK VERIFICATION AND VALIDATION

Data Accuracy Analysis

In order to ensure that data accuracies are maintained during the execution of the firmware in the MOD 30 instruments used for DC Cook system upgrade, a data accuracy analysis should be provided. Using the Math Module software as the basis, provide a trace of selected data elements as they are transformed during the execution of the firmware. A data element is considered transformed when it is moved or copied by the firmware.

For each transformation provide: 1) the variable name; 2) the data type; 3) the value of the variable; 4) the size of the variable in bytes; 5) the scaling factor; and 6) the integer and fraction portions of the internal form of the variable. Show how data accuracy and precision is maintained through all the stages of data transformations.

The list of selected data elements have been taken from the MU 024 Math Module which performs the OT/Delta T calculations:

External Inputs:

Analog Input 1	from P-455	Value= 1900 psi
Analog Input 2	from N-411	Value= 70% flux
Analog Input 3	from T-412A	Value= 610 degrees

Configuration Constants:

LINZ	Table 1 Coefficient A	Value= -0.0438
ALG01	Input 1 Tunable Constant	Value= -8.00
ALG02	Input 1 EU Range	Value= -81.1, 148.1
ALG02	Constant A	Value= -9.056 E0

Result:

ALG02	Field Output 2	Value= (analysis)

A walkthrough of the software using the data values referenced above will be performed August 5-7, 1991, at the Rockville, CE office. Please be able to support this walkthrough in information, documentation and Taylor personnel (as previously discussed during the audit held July 8 - July 12, 1991).

ENCLOSURE 3

DOCUMENTS TO BE TRANSFERRED FROM CE/WINDSOR TO CE/ROCKVILLE

1 RPS System Specification - text only bid and final versions
2 Functional Diagrams - existing and upgrade versions
3 Elementary Diagrams - existing and upgrade versions
4 RPS Rack Arrangement dwgs. Channel 1
5 RPS Rack Assembly. dwgs. Channel 1
6 Qualification Test Plan 98689-ICE-3425
7 Test Report & Test Plan for Seismic Qualification
8 Mod. Package 12-2985
9 Control Room HVAC Calculations for SBO
10 New test reports for Thermal and EMI tests (Seismic?)
11 SIREP Evaluation Report for Taylor Mod 30
12 MTBF data/history for Taylor Mod 30 equipment
13 One Line dwgs. 120 Vac CE and DC Cook
14 Summary Qualification Report - Thermal
15 Report on Power supply loading during thermal qualification
16 FAT Procedure (final)
17 Integrated FAT Procedure (final)

The documents listed above are not all inclusive. The list represents documents the NRC audit team was able to identify as a minimum required to continue the review. Items 1, 2, 3, 4, 5, 8, and 13 will be needed for the "thread" audit scheduled for August 5, 6, and 7, 1991, at the Rockville CE office. Additional documents required for the August audit will include any documents needed to support the "thread" concept as explained to both DC Cook and CE personnel and the documents required to support the software "walkthrough" as explained to DC Cook, CE and Taylor personnel.

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Donald C. Cook Nuclear Plant

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