

February 4, 2000

Mr. R. P. Powers  
Senior Vice President  
Nuclear Generation Group  
American Electric Power Company  
500 Circle Drive  
Buchanan, MI 49107-1395

SUBJECT: NRC INSPECTION REPORT 50-315/99032(DRS); 50-316/99032(DRS)

Dear Mr. Powers:

On January 5, 2000, the NRC completed an inspection at your D. C. Cook Units 1 and 2 reactor facilities. The inspection addressed MC 0350 Case Specific Checklist (CSC) Items No. 3C , "Failure to Consider Instrument Uncertainties, Setpoints and/or Instrument Bias", CSC Item No. 7, "Resolution of Non-Safety Related Cables Going to Shunt Trip Coils", which were established through NRC's Manual Chapter 0350, "Staff Guidelines for Restart Approval". In addition, this inspection addressed Confirmatory Action Letter (CAL) Item No. 9, "Instrument Uncertainties Incorporated into Procedures and Analyses". This inspection assessed corrective actions to address deficiencies identified relative to the items noted above. The enclosed report documents the results of the inspection.

Regarding CSC Item No. 3C and CAL Item No. 9, relating to your instrument uncertainty program, the inspectors determined that you have established the scope of the expanded instrument uncertainty program and that the corrective actions completed provided a reasonable level of assurance that you understood the basic problems associated with this issue. The inspectors concluded that these actions will adequately address this problem and should prevent recurrence. As a result, the NRC concluded that the actions completed regarding the instrument uncertainty program demonstrated adequate resolution of CSC Item No. 3C and CAL Item No. 9.

Regarding CSC Item No. 7, "Resolution of Non-Safety Related Cables Going to Shunt Trip Coils", our review identified that sufficient data was not available for review justifying the use of non-safety related cables in the load shed circuitry. Therefore, this issue will remain open pending the Office of Nuclear Reactor Regulation review of licensing and design basis requirements and the acceptability of the existing cable configurations.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice", a copy of this letter and the enclosure will be placed in the NRC Public Document Room.

R. Powers

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We will gladly discuss any questions you have concerning this inspection.

Sincerely,

***/RA/***

John A. Grobe, Director  
Division of Reactor Safety

Docket Nos. 50-315; 50-316  
License Nos. DPR-58; DPR-74

Enclosure: Inspection Report 50-315/99032(DRS); 50-316/99032(DRS)

cc w/encl: A. C. Bakken III, Site Vice President  
J. Pollock, Plant Manager  
M. Rencheck, Vice President, Nuclear Engineering  
R. Whale, Michigan Public Service Commission  
Michigan Department of Environmental Quality  
Emergency Management Division  
MI Department of State Police  
D. Lochbaum, Union of Concerned Scientists

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U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket Nos: 50-315; 50-316  
License Nos: DPR-58; DPR-74

Report No: 50-315/99032(DRS); 50-316/99032(DRS)

Licensee: Indiana Michigan Power Company

Facility: Donald C. Cook Nuclear Generating Plant

Location: 1 Cook Place  
Bridgman, MI 49106

Dates: November 8, 1999 to January 5, 2000

Inspectors: Z. Falevits, Reactor Engineer, Lead Inspector  
B. Quirk, I&C Engineer, NRC Contractor

Approved by: Gary L. Shear, Chief, Plant Support Branch  
Division of Reactor Safety

## EXECUTIVE SUMMARY

D. C. Cook, Units 1 and 2  
NRC Inspection Report 50-315/99032(DRS); 50-316/99032(DRS)

By NRC letter dated September 17, 1999, the NRC transmitted the updated Case Specific Checklist (CSC) for the Donald C. Cook Nuclear Power Plant which identified specific issues requiring resolution prior to restart of the Cook Plant.

This special inspection focused on licensee corrective actions for resolution of CSC Item No. 3C, "Failure to Consider Instrument Uncertainties, Setpoints and/or Instrument Bias", CSC Item No. 7, "Resolution of Non-Safety Related Cables Going to Shunt Trip Coils", and Confirmatory Action Letter (CAL) Item No. 9, "Instrument Uncertainties Incorporated into Procedures and Analyses". The standard applied to evaluate the acceptability for resolution of these CSC items was that described in paragraphs C.1.1 "Root Cause Determination", C.1.2 "Corrective Action Development", and C.1.3 "Corrective Action Plan Implementation and Effectiveness", as described in the enclosures of the NRC letter transmitting the CSC. Based on inspection results, CSC Item No. 3C, "Failure to Consider Instrument Uncertainties, Setpoints and/or Instrument Bias", and CAL Item No. 9, "Instrument Uncertainties Incorporated into Procedures and Analyses", will be closed. CSC Item No. 7, "Resolution of Non-Safety Related Cables Going to Shunt Trip Coils", will remain open pending completion of the Office of Nuclear Reactor Regulation review.

Open items identified in NRC inspection reports and Licensee Event Reports requiring resolution prior to restart of the Cook Plant have been identified in the Restart Action Matrix (RAM) approved by the NRC Manual Chapter 0350 Oversight Panel. In the RAM, open items were identified with a higher inspection priority. The higher inspection priority issues and a sample of lower priority inspection issues received a more in-depth review during this inspection. Based on adequate corrective actions for resolution of items selected for more in-depth review, reasonable assurance exists that corrective actions for similar lower priority inspection issues are adequate. The intent of selecting a sample of items for more in-depth review was to improve the efficiency of the NRC in assessing the restart readiness of D. C. Cook and to ensure appropriate focus on the issues most important from a safety and probabilistic risk perspective.

### Engineering

- The inspectors concluded that licensee actions to address the concerns associated with failure to consider instrument uncertainties, setpoints and/or instrument bias appeared to be adequate. There was sufficient evidence of completed work combined with other open items linked to restart to close MC 0350 CSC Item No. 3C (Section E8.1).
- The inspectors determined that licensee actions completed to address CAL Item No. 9 provided a reasonable level of confidence that the licensee understood the basic problems, defined the scope of action to be taken and completed sufficient actions to demonstrate adequate progress on this item. Several instrument uncertainty related issues required additional licensee actions including the review of approximately 1100 existing plant procedures and the completion of approximately 208 instrument uncertainty calculations prior to plant restart. These items are identified in the licensee's corrective

action program for closure prior to restart. CAL Item No. 9 is considered closed (Section E8.2).

- The inspectors determined that licensing commitments related to CSC Item No. 7 appeared inconsistent and that electrical separation documents were not clear or concise and contained what appeared to be conflicting or insufficient information. Region III requested NRR's assistance in evaluating this concern to determine if the existing cable configuration is acceptable (TIA 99-031). This item remains open (Section E8.3).
- The inspectors concluded that CR 97-2312 adequately captured the problems associated with the failure to properly account for all RWST level measurement and uncertainties. The licensee implemented corrective actions and adequately resolved the technical issues associated with this problem. However, the inspectors identified some problems related to administration of the corrective action items which the licensee entered into the corrective action program. RAM Item No. R.2.3.22 is closed (Section E8.4).
- The inspectors concluded that the problem concerning the failure to adequately address environmental effects on containment recirculation sump instruments used in the emergency operating procedures (EOPs), and a failure to fully address vortexing, air entrainment, or net positive section head (NPSH) requirements was adequately captured in CR 97-2312. The root cause was determined to be ineffective written communications associated with a change in the design basis. The design change 2-DCP-4346 which was initiated to address this problem and which is required for restart has not yet been issued at the time of this inspection (Section E8.5).

## Report Details

### Background

Past NRC inspections and licensee audits and self-assessments identified various concerns relative to instrument setpoint control program and non-safety related cables used in safety related applications. As a result of these concerns, the licensee conducted self-assessments and root cause investigations to identify other related problems and their root causes. To address the deficiencies identified, the licensee initiated a Restart Action Plan to identify the corrective actions, that needed to be taken to address the problems noted and to prevent recurrence. As part of the corrective actions the licensee has reviewed emergency procedures and other important-to-safety procedures, calculations, and analyses to account for instrument uncertainties. In addition, cable installation licensing and design basis documentation were reviewed.

The inspectors examined the licensee's actions to identify the related root causes, the restart acceptance criteria, and the corrective actions initiated and completed to resolve the identified concerns and to prevent recurrence.

### III. Engineering

#### **E8 Engineering-Miscellaneous Issues**

##### **E8.1 Manual Chapter (MC) 0350 Restart Case Specific Checklist (CSC) Item No. 3C, "Failure to Consider Instrument Uncertainties, Setpoints, and/or Instrument Bias"**

###### **a. Inspection Scope (92903, 93807)**

The inspectors reviewed the licensee's Restart Action Plan (RAP) for NRC MC 0350 CSC Item No. 3C, and various documents referenced by the licensee as justification for closing individual activities in the plan.

###### **b. Observations and Findings**

NRC inspection report 50-315/98009, 50-316/98009 documented several unresolved items and escalated enforcement items related to instrument uncertainties and bias. The NRC informed the licensee in a letter dated July 30, 1998, that a restart oversight panel had been established in accordance with NRC MC 0350. In a letter dated October 13, 1998, the NRC issued a checklist of activities that the NRC considered necessary for the licensee to address prior to restarting the plant. Checklist Item No. 3C addressed the failure to consider instrument uncertainties, setpoints, and/or instrument bias.

The licensee prepared a detailed restart action plan (RAP) to address the issue of failing to consider instrument uncertainties and bias. The inspectors noted the RAP was consistent with guidance provided in PMP 7200.RST.001 "RESTART ACTION PLANS", and was approved on November 5, 1999 by the Restart Program Manager, System Readiness Review Board (SRRB), and Senior Management Review Team (SMRT).

The various condition reports (CRs) developed to address the problems associated with CSC Item No. 3C, including CR-97-2132, CR 97-2350, CR 97-2456, CR 97-3518, and CR 97-3519, captured the specific details of this problem. The inspectors concurred that the various CRs addressed the problems, which in the aggregate resulted in CSC Item No. 3C. The root and apparent causes in the CRs were reasonable. These actions are appropriate to close CSC Item No. 3C.

The inspectors identified the following deficiencies during review of CSC Item No. 3C closure package action items.

Subsequent to the initial inspection week the licensee reported calculation ENSM970606JJR was being superceded by a new calculation which would support operation of the residual heat removal (RHR) and containment spray (CTS) pumps at a lower RWST level; this would result in further changes to the RWST level setpoints used in Procedure ES-1.3. Additionally, the action item closure document addressed Engineering Control Procedure (ECP) 1-RPC-09 and 2-RPC-09 "RWST Level" Revisions 3 and 4, respectively. These ECPs referenced ECP-12-I9-03, Revision 17 for the "installed" setpoint. The licensee knew the setpoint in ECP-12-I9-03 required revision when the action item closure documentation was prepared and approved; however, this was not noted on the closure package. The inspectors concluded ECP-12-I9-03 should have been included in the CSC Item No. 3C, Action Item 3 closure package, should have included a link to the future corrective actions associated with new vortex calculations and ECP-12-I9-03 and ES-1.3 changes should have also been provided. The licensee's revision of the ECPs will address the identified deficiencies.

Action Item four addressed the post accident instrument uncertainties which were not correctly included when establishing containment sump level necessary for initiation of emergency core cooling system (ECCS) recirculation mode in Procedure ES-1.3. ES-1.3, Revision 4 was initiated to use the post accident containment sump levels rather than the recirculation sump levels for verification of adequate water transfer. Subsequent to that procedure modification, the licensee determined the containment sump level instrument uncertainties were too large to ensure proper pump operation in recirculation mode. The licensee Instrument and Control (I&C) design supervisor stated that design change 2-DCP 4346, was initiated to install qualified level switches accurate enough for use in ES-1.3, Revision 6 rather than analog containment level instruments.

c. Conclusions

The inspectors concluded that licensee actions to address the concerns associated with failure to consider instrument uncertainties, setpoints and/or instrument bias appeared to be adequate. There was sufficient evidence of completed work combined with other open items linked to restart to close MC 0350 CSC Item No. 3C.



E8.2 Confirmatory Action Letter (CAL) Item No. 9 -“Instrument Uncertainties Incorporated into Procedures and Analyses”

a. Inspection Scope (92903, 93807)

The inspectors reviewed the licensee and NRC documentation related to CAL Item No. 9, the violations which led to this requirement for corrective action, licensee commitments, and licensee actions completed to date. Items reviewed included the CAL Item No. 9 closure package, plant procedures, engineering guides (EG), Technical Directive Memorandum (TDM), calculations, and internal and external assessments of the program. Remaining activities needed to complete the commitment were reviewed with a focus on their impact not only for restart but also on maintaining the program after restart. Engineering supervisors, engineers and senior licensed operators were interviewed.

b. Observations and Findings

CAL Item No. 9 required the licensee to review emergency procedures and other important-to-safety procedures, calculations, or analyses to account for instrument uncertainties. Actions to address this item did not have to be completed prior to restart.

In a letter dated December 2, 1997, the licensee responded to CAL Item No. 9 by committing to an expanded instrument uncertainty program to provide the methodology for performing the review, with a scheduled completion in 1998. The committed scope of the program included reactor trip and engineered safety feature actuation system (ESFAS) setpoints, emergency and abnormal operating procedures (EOPs and AOPs), operations and test procedures used to verify Technical Specification compliance, plant performance data used in safety analyses, and setpoints for plant alarms associated with monitoring Technical Specification compliance.

The licensee also committed to have a plant specific methodology manual which would be used to calculate instrument uncertainties using techniques similar to those described in Branch Technical Position HICB-12, "Guidance on Establishing and Maintaining Instrument Setpoints". Additionally, the licensee committed to develop administrative controls to assure that instrument uncertainties were considered in development or revision of procedures, calculations, and analyses.

In a letter dated September 8, 1998, the licensee revised the completion date for this effort from December 31, 1998 to December 31, 1999. The licensee I&C design supervisor stated during the inspection that the commitment was being modified again with Unit 2 related work scheduled for completion by February 29, 2000, and Unit 1 work to be completed prior to Unit 1 restart.

During this inspection, the inspectors noted that a licensee assessment of the instrument uncertainty program addressed in RST-1999-005-NED "Independent Assessment of Instrument Uncertainty Program" dated June 30, 1999, identified that the program scope was not clearly defined and that there were inconsistencies between procedures, engineering guides, and other documents. During the inspector's review of the CAL Item No. 9 closure package similar issues were identified. On December 30, 1999, the

licensee I&C supervisor stated that procedure PMP 5030.001.002 "Control of Critical Parameters", Revision 4 was in the final stages of review and approval. The inspectors concluded that this would resolve most of these problems by clearly defining the program scope and detailing how the program would be implemented. The individual also stated that ECP 1-2-00-44 "Critical Parameters List", Revision 0, would be issued by February 29, 2000. This document would be a list of all critical parameters, and would be a primary input to PMP 5030.001.002.

The approach taken by the licensee to address the instrument uncertainty issue was broad based and was still in progress during the inspection. It included the review of essentially all plant procedures, except those of a purely administrative nature, to identify plant process parameters used by the procedures. There was a subsequent evaluation to determine if instrument uncertainty needed to be applied. The licensee identified approximately 1100 Unit 2 and common plant procedures which required review; 704 required a detailed review. As of December 17, 1999, 247 of these reviews were approved, and 255 procedure reviews were prepared and awaiting final approval.

The procedure review resulted in changes to the critical parameter list (CPL) which identified plant process parameters used to determine the operability of Technical Specification equipment, support Technical Specification system operability, or determine Technical Specification compliance. The inspectors noted that in Engineering Technical Directives Memorandum (ENTDM) 98-08 "Critical Parameter List," Revision 2, there were over 300 critical parameters. The licensee discontinued the use of ENTDM, and future changes will be documented in ECP 1-2-00-44, Revision 0.

The CPL review has resulted in the need to complete approximately 208 instrument uncertainty related calculations. At the end of the onsite inspection period approximately 40 of these were approved, and by December 17, 1999, a total of 45 were approved. The I&C design supervisor stated many of the other calculations were prepared but were still in the review, comment incorporation, and approval process. At the end of the onsite inspection period Performance Assurance (PA) had not reviewed any of these new uncertainty calculations. The licensee I&C design supervisor acknowledged the remaining procedure reviews would probably require additional uncertainty calculations such as one for the secondary plant heat balance used to calibrate power range nuclear instrumentation. The inspectors concluded that the approach to identify critical parameters and identify which ones required instrument uncertainty calculations was adequate but a significant effort remained.

The licensee complied with commitments to develop a manual and review checklist for instrument uncertainty calculations by modifying EG-IC-04 "I&C Engineering Guide for Instrument Setpoint/Uncertainty," Revision 3. The guide included Appendix E, "Checklist for Instrument Uncertainty Calculations" as an aid for calculation preparers and reviewers as a means to ensure the uncertainty calculations met performance standards. The inspectors concluded the documents were acceptable guidelines for calculation preparers and reviewers.

The licensee also completed steps to ensure that instrument uncertainties were considered in development or revision of procedures, calculations, and analyses. The licensee conducted instrument uncertainty training for engineers and procedure writers.

The inspectors reviewed procedure PMP-2010.PRC.002 "Procedure Correction, Change, and Review", Revision 4, dated December 14, 1999, and were unconvinced that changes to the procedure would be effective in ensuring procedure writers properly use instrument uncertainty in procedures. The licensee I&C design supervisor concurred that the procedure did not add much to the process, but noted that there were multiple reviews for new and revised procedures so the chances of a misapplication of engineering developed uncertainties were remote. Additionally, procedure writer re-training on the use of instrument uncertainty in procedures was scheduled as a post-restart activity. The inspectors concluded that the reviews and re-training would enhance the effectiveness of the program.

CAL Item No. 9 is considered closed based on inspection results indicating that the licensee has established the scope of the expanded instrument uncertainty program. However, the inspectors determined that the program controlling document, PMP 5030.001.002 "control of critical parameters", needed to be revised to correctly reflect the instrument uncertainty program scope and implementation.

The licensee informed the NRC that the review of approximately 1100 existing plant procedures will be completed prior to plant restart to identify the use of plant process parameters. In addition, the licensee stated that approximately 208 instrument uncertainty calculations will be performed and issued prior to plant restart.

c. Conclusions

The inspectors determined that licensee corrective actions completed to address this item provided a reasonable level of confidence that the licensee understood the basic problems associated with CAL Item No. 9. This item is considered closed. However, the inspectors determined that several instrument uncertainty related issues required additional licensee actions including the review of approximately 1100 existing plant procedures and the completion of approximately 208 instrument uncertainty calculations prior to restart.

E8.3 (Discussed/Open) MC 0350 Restart Action Matrix (RAM) Item No. R.2.7.5, "Non-Safety Related Cables Routed to Safety Related Equipment"; CSC Item No. 7, "Resolution of Non-Safety Related Cables Going to Shunt Trip Coils" (LER 50-315/98-016-02; 50-316/98-016-02)

a. Inspection Scope (92903, 93807)

The inspectors reviewed documentation related to CSC Item No. 7 including engineering RAP, "Resolution of Non-Safety Related Cables Going To Shunt Trip Coils", regulatory codes, industry standards, design and licensing basis documents, electrical design drawings and self-assessments. In addition, the inspectors interviewed design engineers.

b. Observations and Findings

CSC Item No. 7 and RAM Item No. R.2.7.5 concerned non-safety related cables used in the load shed circuitry to perform the safety related function of emergency diesel

generator (EDG) load shedding. These cables were not installed in safety related trays with divisional separation.

The licensee prepared a detailed RAP to address this issue. The RAP was consistent with guidance provided in PMP 7200.RST.001 "RESTART ACTION PLANS", and was approved on November 5, 1999 by the Restart Program Manager, System Readiness Review Board (SRRB), and Senior Management Review Team (SMRT).

This issue was identified by a system engineer in March 1998 at which time all four EDGs were declared inoperable. The licensee issued LER 98-016 which was subsequently retracted. The licensee's investigation of this issue concluded that the related load shed cables will perform their intended safety function of EDG load shedding. The licensee also determined that based on current plant design, the EDGs are not designed to carry all loads that are normally connected to the safety buses.

The control cables used to shed non-safety loads from both safety related EDG trains/buses had been classified, during initial plant design, as non-safety related. Consequently, these load shed cables were installed in Balance of Plant (BOP) trays and allowed to run next to each other without physical separation. These cables perform the safety related function of EDG load shedding following a loss of offsite power and loss of offsite power with safeguards initiation. The subject BOP loads are fed by 600V switchgear buses and 480V Motor Control Centers (MCCs). Approximately 50 percent of the loads on these safety related buses are non-safety related BOP loads.

The inspectors noted that licensing and design bases information used by the licensee to classify these cables during plant construction were based on requirements of IEEE 279-1968, "Criteria for Nuclear Power Plant Protection Systems", and IEEE 308-1970, "Criteria for Class 1E Electrical Systems for Nuclear Power Generating Stations". The inspectors reviewed IEEE standards IEEE 279-1968 and IEEE 308-1970, D. C. Cook design basis documents, the Safety Evaluation Report and related NRC staff questions asked during the licensing review process.

IEEE 279-1968 states in part, plant system protection encompasses all electric and mechanical devices and circuitry from sensors to actuation devices input terminals involved in generating those signals associated with the protective function. The licensee interpreted "from sensor to actuation device" to mean from relay contact to relay being energized by this contact rather than from initiation contact to the breaker coil (actuation device). IEEE 308-1970 states in part, sufficient physical separation, electrical isolation and redundancy shall be provided to prevent the occurrence of common failure mode in class IE systems. It further states, distribution circuits to redundant equipment shall be physically and electrically independent of each other.

Review of design basis documents revealed that the licensees electrical design and installation criteria for Reactor Protection and ESF design cable systems, dated August 1976, allowed loads not identified as safety related but which are fed from safety related buses to have their respective control circuits treated as non-safety related (even though they may be used in the load shedding logic to perform a safety related function).

To address the concern that a faulted BOP cable associated with a load off the EDG bus will not degrade adjacent control cables below an acceptable level and possibly prevent the load shedding logic from performing its intended function the licensee performed cable tests under very high fault current levels. The licensee used procedure AEP No. 227440-CDM-5400-02, Rev. 0, "Effects of Fault Currents in Control Circuits Application - Test, Plans and Guidelines". One of eleven tests conducted produced a control cable failure and 8 of 48 adjacent cable conductors failed. The licensee stated that they believe that based on anticipated fault currents the control cables can withstand credible faults and remain functional. The licensee could not provide the anticipated current values at the time of the inspection.

The inspectors noted that the subject cables were routed as BOP cables and review of cable pulling cards indicated that quality control was apparently not involved in the pulling activities of the sample of cables reviewed by the inspectors. When questioned, the licensee informed the inspectors that an evaluation was conducted to assess the impact of this configuration on Appendix R, Seismic and HELB and no concerns were noted.

The inspectors also reviewed self-assessments relating to cable separation and routing at D. C. Cook and interviewed Performance Assurance (PA) auditors that reviewed this area of concern. In particular, inspectors reviewed Assessment No. SA-1999-009 NED titled, "Cable Routing and Separation", dated June 11, 1999 which also examined the subject BOP cable. The PA assessment team concluded that actions taken in response to CR-98-1129 and the related LERs were not effective. The PA auditors concluded that licensing commitments appeared inconsistent, and that electrical separation documents are not clear or concise and contain conflicting or insufficient information. The inspectors concurred with these findings. As a result, review of this issue was referred to NRR via TIA 99-031 for additional assessment to determine the acceptability of existing cable installations.

c. Conclusions

The inspectors determined that licensing commitments related to non-safety related cables in the load shed circuitry appeared inconsistent and that electrical separation documents were not clear or concise and contained what appeared to be conflicting or insufficient information. Region III requested NRR's assistance in evaluating this concern to determine if the existing cable configuration is acceptable (TIA 99-031). This item remains open.

E8.4 (Closed) MC 0350 Restart Action Matrix (RAM) R.2.3.22, Escalated Enforcement Item (EEI) 50-315/98009-01; 50-316/98009-01: Apparent Failure to Recognize and Evaluate all Refueling Water Storage Tank (RWST) Level Measurement Error and Uncertainties

a. Inspection Scope (92903, 93807)

The inspectors reviewed licensee actions taken to resolve EEI 50-315/98009-01; 50-316/98009-01 concerning the failure to properly account for all RWST level measurement errors and uncertainties. This issue is also tracked as LER 50-315/97011-02. The review was consistent with the RAM closure review methodology for high significance items. Condition reports were reviewed to ensure they captured the RAM issue scope,

the root cause was reviewed, and a detailed corrective action review was completed including ensuring the corrective actions were adequate and tracked to the appropriate restart milestone.

b. Observations and Findings

The Architectural and Engineering (AE) team noted that the Refueling Water Storage Tank (RWST) level instrument pressure taps were located on the RWST suction pipe for the emergency core cooling system (ECCS) and containment spray (CTS) pumps. Flow through the pipe resulted in indicated RWST level being less than actual level. The RWST level was used to determine when operators changed from ECCS and CTS injection mode to recirculation mode. As a result of not adequately addressing flow induced level errors in uncertainty calculations the control room operators could transfer from the injection mode to recirculation mode with the volume of injected water being less than that assumed in accident analysis. This was one of the issues addressed in CR 97-2312. The other CR 97-2312 issue concerned containment sump level instrument problems addressed in Section E8.5

The inspectors concurred that the root causes were adequate. The CR contained 12 corrective actions identified in the evaluation, but four of these were associated with containment sump level. The first six and last two were related to the RWST level and are discussed below.

The first corrective action was to move the level instrument pressure taps from the suction pipe to a static column. This was completed under Design Change Package (DCP) 12-DCP-0853 "Modification to ILS-950 and 951", Revision 0. The inspectors walked down the RWST water level instrument tap modification and determined that the DCP resolved the basic problem which was flow induced errors. The new level uncertainty was adequately captured in calculations.

The second corrective action related to the extent of condition and required a review of other level measurement systems that interface directly with a flowpath. This review was completed and captured in a licensee document "Review of Safety Related Level Instrumentation for Flow Induced Errors" dated December 3, 1997, and in Design Information Transmittal (DIT) DIT-B-00244-00, dated September 30, 1999. Three other instances were identified: condensate storage tank level, mid-loop level, and reactor vessel level indication system (RVLIS). These were resolved by "accept as-is" analyses and level uncertainty calculation changes.

The third, fourth, and fifth corrective action items addressed the incomplete understanding of RWST level instrumentation use.

The third corrective action was for I&C engineering to implement a policy requiring documentation from other technically responsible engineering sections when instrument uncertainty calculations relied on analyses more appropriately performed by other sections, such as flow induced pressure drops. The inspectors identified the following two problems with this corrective action: (1) the required corrective action was not formally captured in the corrective action program, and (2) the policy was not formalized.

The inspectors noted that procedure 12 EHP 5040 DES.003 "Calculations", Revision 2a, required better documentation of the design input data references which could help prevent this problem in the future. Likewise the overall restart effort with its emphasis on removing barriers between organizations and an emphasis on team work could help prevent this. However, the licensee could not identify where the I&C policy was documented, nor was the corrective action captured as a specific item in the corrective action program. This issue was discussed with licensee staff who were evaluating corrective actions.

The fourth corrective action was to revise the Final Safety Analysis Report (FSAR) to clearly indicate assumptions associated with minimum level in containment. This action was still open and tracked as Commitment Management System (CMS) Item No. 7252. This action will not be completed until the containment analysis associated with CAL Item No. 1 is complete.

The fifth corrective action required Engineering Control Procedure (ECP) 1-2-00-14, "Emergency Operation Procedure Setpoints" revision addressing the RWST level used as the basis for swapping from ECCS injection to recirculation. The completed revision addressed the basis for the value, and was based on new and revised calculations as well as feedback from operations on the best value to use. The inspectors noted that the I&C section worked closely with the operations and the training departments in the revision of the setpoint, and more minor changes were possible as revisions to the accident analyses and emergency procedures were prepared, reviewed, verified, and validated. The inspectors also noted that the licensee was evaluating the setpoint for further revision based on revised accident analysis and a proposed change to the Technical Specifications submitted on October 1, 1999 in "Technical Specification Change Request Containment Recirculation Sump Water Inventory".

The sixth corrective action was to revise procedure 01(02)-OHP 4023.ES-1.3 "Transfer to Cold Leg Recirculation" to ensure sufficient water was transferred from the RWST to the containment sump to support operation in the recirculation phase. The inspectors noted that Revision 5 of this procedure addressed this issue, and a draft of Revision 6 dated November 19, 1999 had further changes planned in response to CAL Items No. 1, 4, and 9.

The seventh through tenth corrective actions addressed containment sump level actions and are addressed in Section E8.5.

The eleventh corrective action required engineering design standards to include consideration of flow induced bias in level instrument installations or modifications. The inspectors verified that 227400-STG-5400-07 "Design Change Reference Guide", Revision 2, resolved this issue.

The twelfth corrective action required a revision of instrument uncertainty guide EG-IC-004 to detail flow induced Bernoulli effects. The inspectors noted that the licensee added Section 8.3.4 "Process Flow Velocity Effects" to the guide but it was not very detailed and only provided the basic flow energy equation with no guidance on how to use it. During interviews with licensee design engineers, none could calculate the effects with only the information provided in the guide. The licensee I&C design supervisor stated the guide

should have referenced another document for additional guidance, but this was not done. However, the engineers said they would request assistance from other design organizations to calculate the pressure effects. The inspectors determined that the guide was not adequate to calculate the effects on the instruments, but the I&C section policy discussed in the third corrective action discussed above was known. The licensee captured the inadequate corrective action implementation in CR P-99-27117.

In summary, the corrective actions identified in the evaluation adequately addressed this specific problem, generic implications, and recurrence control. Due to a less than fully adequate tracking and closure process for older CRs, the corrective action associated with implementing a new I&C policy requiring assistance from other organizations was not properly tracked. Additionally, the corrective action associated with the update of the engineering guide did not ensure adequate information was provided for use by personnel in the future. Item EEI 50-315/98009-01; 50-316/98009-01 is considered closed.

c. Conclusions

The inspectors concluded that CR 97-2312 adequately captured the problems associated with the failure to properly account for all RWST level measurement and uncertainties. The licensee implemented corrective actions and adequately resolved the technical issues associated with this problem. However, the inspectors identified some problems related to administration of the corrective action items which the licensee entered into the corrective action program. RAM Item No. R.2.3.22 is closed.

E8.5 (Discussed) MC 0350 RAM 2.3.25 EEI 50-315/98009-05; 50-316/98009-05: Uncertainty Calculations for the Containment and Containment Sump Level Instrumentation Loops do not Account for the Impact of Post-Accident Containment Water Levels (ECPs 1-2-N3-01, 1-RPC-14, and 2-RPC-14,) and do not Consider the Potential for Vortexing, Air Entrainment, or NPSH Requirements

a. Inspection Scope (92903, 93807)

The inspectors reviewed licensee actions taken to resolve item EEI 50-315/98009-05; 50-316/98009-05 concerning the failure to adequately address environmental effects on containment recirculation sump instruments used in the EOPs, and a failure to fully address vortexing, air entrainment, or net positive suction head requirements. The review was consistent with the RAM closure review methodology for high significance items. Condition reports were reviewed to ensure they captured the RAM issue scope, the root cause was reviewed, and a detailed corrective action review was completed including ensuring the corrective actions were adequate and tracked to the appropriate restart milestone.



b. Observations and Findings

The problem was adequately captured in CR 97-2312. The root cause was determined to be ineffective written communications associated with a change in the design basis. The minimum required level in the containment sump necessary for ECCS and containment spray pumps was not adequately communicated.

The licensee determined that the following four corrective action items needed to be completed to address this issue:

- revise ES-1.3 to use containment sump and not the recirculation sump to confirm the level in the sump was adequate to support transition to the recirculation mode, and update setpoint values to include harsh environmental conditions
- validate all EOP footnote values
- update the ECCS system description to include the basis for the swapover level, and
- revise ECP 1-2-00-14 to document the requirement for the minimum containment sump level.

The inspectors noted that the EOPs were revised prior to completing the CR evaluation. The inspectors verified that SD-12-ECCS-100 was adequately updated. Since the time the CR evaluation was completed the licensee decided to update all the EOPs to be more consistent with the Westinghouse owners Group guidelines. Additionally, the licensee determined that the containment sump level instrument was not accurate enough to support the new accident analysis values. Therefore, design change 2-DCP-4346 "Discrete Containment Level indicator in Main Control Room" was initiated and was scheduled for Plant Operations Review Committee (PORC) review December 13, 1999. The design change was required for restart. After the DCP is issued, a review of the design is needed to ensure that the new design adequately addressed critical issues such as single failure, environmental qualification, and setpoint uncertainty. This item remains open pending review of adequacy of design change 2-DCP-4346.

c. Conclusions

The inspectors concluded that the problem concerning the failure to adequately address environmental effects on containment recirculation sump instruments used in the EOPs, and a failure to fully address vortexing, air entrainment, or NPSH requirements was adequately captured in CR 97-2312. The root cause was determined to be ineffective written communications associated with a change in the design basis. Since design change 2-DCP-4346 which is required for restart has not yet been issued at the time of this inspection, this EEI, RAM Item No. 2.3.25, will remain open.

E8.6 (Closed) Unresolved Item URI 50-315/98009-19, URI 50-316/98009-19, URI 50-315/98009-20, URI 50-316/98009-20, URI 50-315/98009-21 and URI 50-316/98009-21 - Resolution of Miscellaneous Instrument Loop Uncertainties

The AE inspection team noted that the licensee did not have instrument uncertainty calculations for several instruments related to Technical Specifications. This was addressed as URI 50-315/98009-19 and URI 50-316/98009-19 for component cooling

water (CCW) heat exchanger outlet temperatures, URI 50-315/98009-20 and URI 50-316/98009-20 for emergency service water (ESW) intake temperatures, and URI 50-315/98009-21 and URI 50-316/98009-21 for control room temperatures. These were also identified as low priority RAM Items No. R.2.3.34, R.2.3.35, and R.2.3.36, respectively. These problems were all captured in CR 97-3518. The licensee developed instrument uncertainty calculations for each of these parameters. Specifically, calculations 1-WSI-04 and 2-WSI-04, Revision 1, addressed CCW heat exchanger calculation, 12-W0-01, Revision 4, addressed ESW intake temperatures, and calculation 1-B1-07, Revision 0, addressed control room temperature. The calculations, while not consistent with the latest format for calculations, were adequate to address the issues and close the associated RAM items. URI 50-315/98009-19, URI 50-316/98009-19, URI 50-315/98009-20, URI 50-316/98009-20, URI 50-315/98009-21 and URI 50-316/98009-21 are considered closed.

E8.7 (Closed) Unresolved Item 50-315/98009-22; 50-316/98009-22 Setpoint Control Program (R.2.3.37)

The AE inspection team questioned the control of setpoints beyond the systems they reviewed. The licensee initiated CR 97-3519 to address this issue. The resolution was to implement a critical parameter list, which is one aspect of CAL Item No. 9 and per I&C supervisor will be completed prior to plant restart. The URI and associated low priority RAM Item No. R.2.3.37 are closed.

## **V. Management Meetings**

### **X1 Exit Meeting Summary**

On November 19, 1999 and on January 5, 2000, the inspectors presented the inspection results to licensee management. The licensee acknowledged the findings presented.

The inspectors asked the licensee whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

## **PARTIAL LIST OF PERSONS CONTACTED**

### Licensee

C. Bakken, Site Vice President  
R. Crane, Regulatory Affairs  
R. Gaston, Regulatory Compliance Manager  
R. Godley, Director, Regulatory Affairs  
S. Greenlee, Director Design Engineering  
N. Jackiw, Licensing  
J. Kovarik, Electrical I&C Engineering Supervisor  
W. Kropp, Director Performance Engineering  
S. Lacey, Director, Engineering Restart  
J. Pollock, Electrical Programs and Design Supervisor  
R. Powers, Senior Vice President  
M. Rencheck, Vice President Engineering  
T. Taylor, Licensing  
L. Weber, Operations

### US NRC

B. Bartlett, Senior Resident Inspector

## **INSPECTION PROCEDURES USED**

IP 92903: Followup-Engineering  
IP 93807: Systems Based Instrument and Control Inspection  
IP 40500: Effectiveness of Licensee Controls in Identifying, Resolving, and Preventing Problems

**ITEMS OPENED, CLOSED, AND DISCUSSED**

Opened

None

Closed

CAL Item No. 9			Instrument Uncertainties Incorporated into Procedures and Analyses
CSC Item No. 3C			Failure to Consider Instrument Uncertainties, Setpoints, and/or Instrument Bias
315/316-98009-01	EEI	R.2.3.22	Apparent Failure to Recognize and Evaluate All Refueling Water Storage Tank (RWST) Level Measurement Error and Uncertainties
315/316-98009-19	URI	R.2.3.34	Resolution of Miscellaneous Instrument Loop Uncertainties
315/316-98009-20	URI	R.2.3.35	Resolution of Miscellaneous Instrument Loop Uncertainties
315/316-98009-21	URI	R.2.3.36	Resolution of Miscellaneous Instrument Loop Uncertainties
315/316-98009-22	URI	R.2.3.37	Resolution of Miscellaneous Instrument Loop Uncertainties

Discussed

315/316-98009-05	EEI	R.2.3.25	Uncertainty Calculations for the Containment and Containment Sump Level Instrumentation Loops do not Account for the Impact of Post-Accident Containment Water Levels (ECPs 1-2-N3-01, 1-RPC-14, and 2-RPC-14,) and do not Consider the Potential for Vortexing, Air Entrainment, or NPSH Requirements
CSC Item No. 7 315/316-98-016-02	LER	R.2.7.5	Resolution of Non-Safety Related Cables Going to Shunt Trip Coils

## LIST OF ACRONYMS USED

AE	Architect Engineer
AOP	Abnormal Operating Procedure
BOP	Balance of Plant
CA	Corrective Action
CAL	Confirmatory Action Letter
CCW	Component Cooling Water
CMS	Commitment Management System
CPL	Critical Parameter List
CR	Condition Report
CSC	Case Specific Checklist
CTS	Containment Spray
DIT	Design Information Transmittal
ECCS	Emergency Core Cooling System
ECP	Engineering Control Procedure
EDG	Emergency Diesel Generator
EEI	Escalated Enforcement Item
EG	Engineering Guide
ENTDM	Engineering Technical Directive Memo
EOP	Emergency Operating Procedure
ESFAS	Engineered Safety Function Actuation System
ESW	Emergency Service Water
FSAR	Final Safety Analysis Report
I&C	Instrument and Control
ICP	Information Change Package
MC	Manual Chapter
MCC	Motor Control Center
NRR	Nuclear Reactor Regulation
PORC	Plant Operations Review Committee
RAM	Restart Action Matrix
RAP	Restart Action Plan
RHR	Residual Heat Removal
RVLIS	Reactor Vessel Level Indicating System
RWST	Reactor Water Storage Tank
SMRT	Senior Management Review Team
SRRB	System Readiness Review Board
TDM	Technical Direction Memorandum
URI	Unresolved Item

## PARTIAL LIST OF DOCUMENTS REVIEWED

### DESIGN CHANGES

12-DCP-0853            Modification to ILS-950 and 951, Rev. 0  
2-DCP-4346            Discrete Containment Level Indicator in Main Control Room, Draft

### PROBLEM EVALUATION REPORTS (Condition Reports)

P-99-27117    EG-IC-004 - not all items are defined in the equation for the Bernoulli effect, Rev. 11/10/99  
P-99-27497    EG-IC-04 Figure 1 has LSSS and Safety Analysis Limit Labels Transposed, Rev. 11/17/99  
97-2312        RWST Level Indication May Read Higher Than Actual Due to Flow Errors, Rev. 8/22/97  
97-2456        01/02-OHP 4030.STP.030 do not take into account instrument uncertainty, Rev. 9/11/97  
97-2350        RWST Minimum, low, and low-low alarm and trip function did not address RHR pump vortexing for low-low RHR pump trip, Rev. 8/26/97  
97-3518        Failure to perform instrument uncertainty calculations, Rev. 12/5/97  
97-2456        Daily and Shiftly surveillance checks do not take into account instrument uncertainties, Rev. 9/11/97  
97-3519        Setpoint Control Programmatic Deficiencies, Rev. 12/5/97  
99-17479       Instrument uncertainty project needs a project plan to tie all the diverse elements together, Rev. 6/30/99  
98-1129        Non-safety related cables used in safety related applications, dated 3/23/98  
P-99-21654    Resolution of Non-Safety Related Caller Going to Shunt Trip Coils

### PROCEDURES

01-OHP 4030.STP.030    Daily and Shiftly Surveillance Checks, Rev. 29 CS 1  
02-OHP 4030.STP.030    Daily and Shiftly Surveillance Checks, Rev. 27 CS 2  
12 EHP 5040 DES.003    Calculations, Rev. 2a  
EG-IC-004                Instrument Setpoint/Uncertainty, Rev. 3 CS 2  
EG-IC-005                Instrument Uncertainty Procedure Review, Rev. 1  
PMP 5030.001.002        Control of Critical Parameters, Rev. 3  
01-OHP 4023.ES-1.3      Transfer to Cold Leg Recirculation, Rev. 5  
ENTDM 98-008            Critical Parameter List, Rev. 2  
PMP-4023.EOP.001        EOP Maintenance, Rev. 0, dated 8/6/99  
PMP-4023.EOP.002        EOP Writers Guide, Rev. 1, dated 10/13/99  
PMP-4023.EOP.003        EOP Verification/Validation, Rev. 1, dated 11/4/99  
12 EHP 5040 DES.003    Calculations, Rev. 2a, dated 10/4/99  
01-OHP 4034.ES-1.3      Transfer to Cold Leg Recirculation, Rev. 5, dated 1/3/98  
PMP5030.001.002        Control of Critical Parameters, Rev. 3, dated 9/18/98  
PMP 7200.RST.001        Restart Action Plans, Rev. 6, dated 10/4/99  
PMP 6065.ISP.001        Plant Instrument Setpoint Control Program, Rev. 1, dated 10/2/98  
227400-STG-5400-07     Design Change Reference Guide, Rev. 2

## CALCULATIONS

1-2-I9-03 CALC6	Refueling Water Storage Tank Level Scaling, Rev. 0
1-2-UNC-339 CALC1	Refueling Water Storage Tank Level Loop Accuracy Calculation, Rev. 1
ENSM 970606JJR	RWST Vortexing, Rev. 2
1-WSI-04	Component Cooling Water System Loop Uncertainty for CCW HX Inlet and Outlet, Rev. 1
2-WSI-04	Component Cooling Water System Loop Uncertainty for CCW HX Inlet and Outlet, Rev. 1
12-W0-01	Circulating Temperature Recorders, Rev. 4
1-B1-07	Steam Generating Shell Temperature Indication and Control Room Temperature Indication, Rev. 0
ECP 1-RPC-09	RWST Level, Rev. 3
ECP 2-RPC-09	RWST Level, Rev. 4
ECP 12-I9-03	RWST Level/RHR Pumps Interlocks, Rev. 17
ECP 1-2-O0-14	Emergency Operating Procedure Setpoints, Rev. 15

## LICENSING DOCUMENT CHANGE REQUESTS

Technical Specification Change Request - Containment Recirculation Sump Water Inventory, Rev. 10/1/99

## MISCELLANEOUS DOCUMENTS

RST-1999-005-NED	Independent Assessment of Instrument Uncertainty Program
DIT-B-00244-00	AEP White Paper - Engineer Inspection Review of Safety-Related Level Instruments for Flow Induced Error, Rev. 0
DIT-B-00174-00	Rev. 0
ENTDM 98-08	Critical Parameter List, Rev. 2

- D. C. Cook Electrical Design and Installation Criteria for Reactor Protection and Engineered Safeguards Cable Systems”, dated 8/27/70
- FSAR Chapter 7 (page 7.2-13), Amendment 20, 3/72
- FSAR Chapter 7, Question 7.5
- FSAR Chapter 8, Amendment 84, 6/79
- Unit 1 SER, dated 9/10/73
- Unit 2 SER, dated 12/23/77
- FSAR Question Q40.11, Amendment 79, 11/77
- FSAR Question Q40.14, Amendment 78, 10/77
- Latest copy of UFSAR Chapters 7 & 8
- Unit 2 SER, dated 12/23/97 (8.3(6))
- Cook Test Report for Fault Current in Control Circuit Applications, dated 6/16/98
- Cable Pulling Cards for Cables 4863G-1, 4859G-1, 4868R-1, 4861G-2, and R8008R
- Cook Restart Action Plan 7, Rev. OC, dated 11/5/99
- Specification ES-CABLE-0221-QCN “Design and Installation Criteria for Cable, Trough and Conduit”, dated 10/11/98
- Drawing 1-12002-32, Rev. 32
- Assessment No. SA-1999-009-NED “Cable Routing and Separation”, Rev. 0, dated 6/11/99

- IEEE-274, 1968 - "Criteria for Nuclear Power Plant Protection Systems"
- IEEE-308, 1970 - "Criteria for Class IE Electrical Systems for Nuclear Power Generating Stations".