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U.S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Mail Stop O-P1-17  
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Donald C. Cook Nuclear Plant Units 1 and 2  
RESTARTING THE UNITS  
REVIEW OF DISCOVERY

The Donald C. Cook Nuclear Plant has essentially completed the first phase of its restart process, Discovery, and implementation of the corrective actions is well underway. To assist the NRC Manual Chapter 0350 Restart Panel in understanding the scope of this phase, Indiana Michigan Power Company has prepared a briefing paper titled Cook Nuclear Plant, Restarting the Units, Review of Discovery, which is attached.

Should you have any questions, please contact Mr. Robert C. Godley, Director of Regulatory Affairs, at (616) 466-2698.

Sincerely,

A handwritten signature in black ink that reads 'M. W. Rencheck'.

M. W. Rencheck  
Vice President Nuclear Engineering

/dms

Enclosure

IE26

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c: J. E. Dyer  
MDEQ – DW & RPD, w/o enclosure  
NRC Resident Inspector  
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**ENCLOSURE TO C1299-13**  
**COOK NUCLEAR PLANT – RESTARTING THE UNITS**  
**REVIEW OF DISCOVERY**

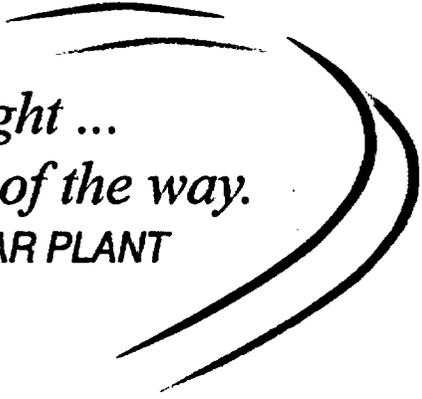
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# **COOK NUCLEAR PLANT**

# **RESTARTING THE UNITS**

**- Review of Discovery -**

*Doing it right ...*  
*Every step of the way.*  
**COOK NUCLEAR PLANT**



## Executive Summary

The purpose of this document is to: (1) summarize Indiana Michigan Power Company's (I&M's) comprehensive discovery efforts; (2) describe the effective identification of issues; and (3) offer a preliminary characterization of what the discovery efforts have found to date.

In September 1997, I&M voluntarily shut down both of the Donald C. Cook Nuclear Plant (CNP) units to address several design basis problems that were identified during an architect/engineering inspection by the U.S. Nuclear Regulatory Commission (NRC). Follow-on assessments by I&M and the NRC identified further problems. The underlying causes of these problems, including weaknesses in the management of personnel and processes, led to reduced confidence that the plant was ready to restart. I&M subsequently expanded the scope of its ongoing Discovery efforts to include all systems important to the safe and reliable operation of CNP. In addition, I&M initiated detailed assessments of the programs and processes, as well as the organizational capabilities needed to support an operating nuclear facility.

*Discovery process was comprehensive and rigorous*

As part of the comprehensive Restart Plan, Discovery is the first of four phases in the recovery and safe restart of the CNP units (an overview of the Restart process is provided in the attachment). The fundamental purpose of Discovery was to identify and understand the problems with plant systems and equipment, management processes, and the capabilities of site personnel. Discovery included the Expanded System Readiness Reviews (ESRR) – a review of safety-significant and important-to-reliability plant systems; Programmatic Assessments – an intrusive review of the adequacy of the programs critical to safe restart; and Functional Area Assessments – a review of critical departments to ensure that plant personnel will be ready to support restart. I&M has essentially completed the Discovery phase of the restart process for the CNP units. Results from the Discovery phase are thoroughly reviewed by management review boards such as the System Readiness Review Board (SRRB) and the Plant Operations Review Committee (PORC) to assure management's standards are achieved.

*Discovery process provides assurance of effective issue identification*

The Discovery process ensures that problems important to safe and reliable operation of CNP are identified. This process used industry proven techniques, as well as personnel experienced in the recovery and restart of nuclear plants. The problems identified during Discovery were evaluated against the restart criteria set forth in the Restart Plan and classified as restart-required or post-restart. These restart criteria encompass nuclear safety, operability, design or licensing basis, and reliability, and provide prioritization for resolution prior to restart of those items which could adversely affect safe or reliable plant operation.

A range of problems was identified during the Discovery process, including management and process weaknesses as well as technical problems. The technical problems arose primarily from the management and process weaknesses, and many involve incomplete or inadequate justification of the design rather than substantive deficiencies in the original design or plant hardware.

*Some functionality problems were identified*

Based on the reviews completed, primarily through ESRR discovery, the initial reports indicated that several systems (e.g., Ice Condenser, Emergency Diesel Generators, Emergency Lighting Packs, Steam Generator Blowdown and Auxiliary Building Ventilation (Spent Fuel Pit)) may not have been fully capable of meeting their safety and accident mitigation functions. As of the date of this report, subsequent analyses are demonstrating satisfactory functional capabilities for the Ice Condenser and Auxiliary Building Ventilation (Spent Fuel Pit) systems with the originally identified discrepancies. Further analyses on plant systems are continuing.

Further, a number of other technical issues have the potential to impact the safety and accident mitigation functions of additional Structures, Systems or Components (SSCs). Evaluation of these technical issues is continuing. The majority of the problems evaluated to date through the Discovery process, while requiring substantive effort to resolve, have had limited safety significance.

*No new generic issues identified*

An evaluation was also conducted of the Functional Area and Programmatic Assessment results to determine if new generic issues existed and whether the generic issues could affect the ability of the plant and/or staff to safely start up and operate the CNP units. This evaluation did not identify any previously unrecognized issues.

The problems identified during the Discovery process are being resolved within the Corrective Action Program (CAP). The CAP will evaluate the extent-of-condition for the individual problems, as well as the potential generic applicability. The combination of the Discovery process and the associated corrective actions for these problems will provide reasonable assurance that the plant, processes and personnel at CNP are ready to support safe and reliable restart and operation of the units.

*Restart:  
Safety First focus*

When the Discovery phase was essentially completed, the Restart effort moved into the Implementation ("fix the plant") phase. This phase is led by Operations. The goal is to do the work right the first time. In essence, this means that work activities and schedule will be properly balanced with a safety first focus.

*Experienced  
leadership team*

A strong management team with substantial operations and restart experience was assembled to return the units to safe and reliable service. This team is raising performance standards, providing requisite training, and instilling a questioning attitude and accountability in the workforce. Also, the team is assuring that a safety conscious culture is maintained.

I&M has established an overall vision of readiness for restart of the Cook Nuclear Plant (CNP). The following criteria will demonstrate CNP's readiness to restart:

*We have a clear  
vision of restart  
readiness*

- Plant systems are capable of performing their safety and accident mitigation functions;
- Personnel and processes are ready to support safe restart and continued operations; and
- Key indicators show an overall improving trend.

Fulfilling this vision provides reasonable assurance that the units will be safely and reliably restarted and operated.

*Beyond Restart*

The collective Restart efforts will not only ensure the safe and reliable start up of the CNP units, but also set the foundation for future performance. I&M's goal is top quartile performance as we move beyond restart. This journey to excellence will not take place in the short term. Both management and employees will continuously strive for sustained improvement.

# Review of Discovery

## Background

In September 1997, I&M voluntarily shutdown both CNP units in consideration of several design basis problems identified during an architect/engineering inspection by NRC. Follow-on assessments by I&M and the NRC led to the identification of further problems with the design basis, material condition and maintenance practices associated with the ice condenser, equipment for post-accident recirculation from the containment sump, and the containment hydrogen mitigation systems.

Subsequent assessments through late 1998 continued to uncover similar issues in other areas of the plant. The underlying causes of these issues, including weaknesses in the management of personnel and processes, led to reduced confidence that the plant was ready to operate. This led to the decision to expand the scope and depth of problem discovery in order to more thoroughly evaluate the extent of condition for these issues. The expansion included all systems important to the safe and reliable operation of CNP, as well as detailed assessments of the programs and processes, and organizational capabilities required to support an operating nuclear facility. Important aspects of the expanded Discovery process are discussed below and an overview of the Restart process is contained in the attachment to this document. This expansion was reflected in a revision to the CNP Restart Plan.

## Discovery Process

Discovery is the first step in preparing CNP for restart. The objective of Discovery is to comprehensively examine the plant systems, programs, and personnel in order to identify, assess, and classify the problems that must be addressed prior to restart of the units. The three primary elements of Discovery are ESRR, Programmatic Assessments, and Functional Area Assessments.

The ESRR establishes a disciplined approach to system assessment, ownership, and accountability, thereby promoting continued safe and reliable plant operation. The ESRR Process begins with the Discovery phase, and continues through the remaining restart phases (implementation, verification, and startup and power ascension). ESRR performed detailed evaluations of

45 systems with safety and accident mitigation functions. Additionally it conducted similar, but less rigorous reviews on essentially all of the remaining plant systems.

Programmatic Assessments are designed to evaluate whether processes are in place and functioning at the time of restart necessary to ensure that SSCs are operated, maintained, modified and tested consistent with the design and licensing bases. Management considered and screened approximately 125 programs for a full Programmatic Assessment review at CNP. Of these, 94 programs have undergone a Programmatic Assessment to identify issues to be resolved prior to restart. Generally speaking, the programs assessed at CNP as part of this effort fall into three areas:

- Programs that support the Design/Licensing Basis – such as the Updated Final Safety Analysis Report review, the Safety Evaluation (10CFR50.59) process and Design Control;
- Programs that ensure the plant will be operated properly within the Design/Licensing Basis – such as the Surveillance Program and the Emergency Operating Procedure Program; and
- Programs that demonstrate management effectiveness – such as Work Control.

Thus, the programs made subject to this review cover the spectrum of processes needed to assure both safe operations of the units and regulatory compliance.

Functional Area Assessments were conducted to determine whether departmental processes, organizations, personnel, and management capabilities are adequate to support startup and safe plant operation. Eighteen plant departments, or functional areas, were assessed at CNP. Among the factors evaluated as part of the Functional Area Assessments were: adequacy of staffing levels, training and qualifications, experience, performance deficiencies, backlog reduction efforts, and the establishment of ongoing improvement goals.

The Discovery process was designed to identify problems that could adversely affect the safe and reliable operation of the CNP units. The Discovery process contained the following attributes to ensure that problems were thoroughly evaluated, commensurate with their safety importance:

*Industry proven process*

- Implementing an industry process proven in recovery and restart of other nuclear plants – to ensure uniformity and rigor in the approach to discovering, reporting and correcting plant problems;

*Experienced personnel*

- Using personnel with a broad base of experience in recovery and restart of nuclear plants, both as I&M managers and as contracted staff augmentation, and use of peers and visits from other nuclear utilities and INPO for selected assessments – to ensure the lessons learned elsewhere are considered in the reviews;

*Comprehensive and intrusive methods*

- Applying comprehensive and intrusive methods; e.g., the Expanded System Readiness Reviews, Programmatic Assessments and Functional Area Assessments over the full range of important systems and processes using a questioning approach – to ensure thorough identification of technical, process and organizational problems;

*Pursuing extent of condition*

- Resolving problems via the Corrective Action Program with consideration of potential extent of condition and generic implications – to ensure not only the observed problem is solved, but the range of other potentially related problems are resolved commensurate with their safety significance;

*Resolve problems important to safe and reliable operation*

- Determining the safety significance of problems using the Corrective Action Program, and ensuring that those problems with substantive effect on the functional capabilities of the plant are corrected – to ensure safety and accident functions are satisfied; and

*Demanding reviews and oversight*

- Subjecting the scope, approach, results and conclusions of the assessments and corrective actions to demanding review and oversight by the Performance Assurance Department and oversight boards, e.g., System Readiness Review Board and Plant Operations Review Committee – to ensure thoroughness and that the experience of other facilities has been adequately considered.

## **Discovery Findings**

I&M is not reviewing every aspect of the design, analyses, procedures, operation, maintenance, and testing. However, the comprehensive and intrusive approach will achieve the objective of providing reasonable assurance.

The problems identified through the ESRR program and functional area reviews fell basically within three areas: (1) technical problems; (2) deficient processes; and (3) ineffective management of personnel and processes.

Regarding technical problems, based on the reviews completed, primarily through ESRR discovery, the initial reports indicated that several systems (e.g., Ice Condenser, Emergency Diesel Generators, Emergency Lighting Packs, Steam Generator Blowdown and Auxiliary Building Ventilation (Spent Fuel Pit)) may not have been fully capable of meeting their safety and accident mitigation functions. As of the date of this report, subsequent analyses are demonstrating satisfactory functional capabilities for the Ice Condenser and Auxiliary Building Ventilation (Spent Fuel Pit) systems with the originally identified discrepancies. Further analyses on plant systems are continuing.

Further, a number of other technical issues have the potential to impact the safety and accident mitigation functions of additional Structures, Systems or Components (SSCs). Evaluation of these technical issues is continuing. The majority of the problems evaluated to date through the Discovery process, while requiring substantive effort to resolve, have had limited safety significance

Examples of other technical problems in the areas of material condition, design and licensing bases, and system design included:

- Underrated fuses in the 250 VDC system;
- High control room temperatures when the Control Room Air Conditioning Coolers are being supplied by the Essential Service Water System at high lake water temperatures;
- Failure to consider the effects of tornado missiles in the design of safety related systems, e.g. EDG intake and exhaust manifolds not protected;

- Lack of equipment environmental qualification in certain areas potentially affected by high energy line breaks;
- Issues with the Spray Additive Tank and addition of the NaOH additive during containment spray (CTS) operation were identified. These relate to the potential for nitrogen gas binding of both CTS pumps and potential problems with delivery of the NaOH during the injection phase of containment spray; and
- Cavitation induced erosion of certain ECCS / SI throttle valves internals due to a deficient design. These valves are used for flow control for post-LOCA recirculation.

Regarding deficient processes, the problems included:

- Weak configuration management;
- Inadequate operability determinations;
- Inappropriate instrument calibration practices;
- Incomplete implementation of the motor operated valve program;
- Weak in-service testing and inspection processes; and
- Weak post-maintenance and post-modification testing.

Regarding ineffective management of personnel and processes, the problems included:

- Failure to establish, communicate and implement management expectations and acceptable standards of performance;
- Failure to always identify conditions adverse to quality, determine root causes, and implement corrective actions in a timely manner;
- Weak organizational and program interfaces;
- Failure to adequately train and qualify personnel in important areas such as the design and licensing basis; and
- Insufficient work management, programs, and processes.

*Discovery  
findings not  
unique*

As described above, the Discovery process was comprehensive and rigorous. When the Discovery findings were compared with the types of problems found in prior I&M assessments and NRC inspections, no new issue categories were identified. In general, when compared with other recent restart efforts, the Discovery findings are not unique.

## **Safety Perspective**

The safety significance of the substantive technical problems are being determined by evaluating their impact on the functional capability of the affected SSCs and on the response of the plant under postulated accident conditions. The majority of the problems identified during the Discovery process have had limited safety significance, although several substantive problems are still being evaluated (e.g. the postulated high-energy line breaks on safety related equipment, see *Licensee Event Report No. 315/99-026-00*).

### *No new generic Issues identified in the Functional / Programmatic Assessments*

A number of issues were also identified during the Functional Area and Programmatic Assessments. Some of these issues, such as those involving the motor operated valve program, equipment qualification and configuration control, could affect SSC functionality. These and the other identified issues were evaluated to determine whether they represented new generic issues that would adversely affect the safe startup and operation of the CNP units. This evaluation did not identify any unrecognized issues. These generic issues are being addressed through the Functional Area Assessments, Leadership Plans, and Restart Plans and monitored within the Corrective Action Program.

I&M has concluded that the assessments performed as a part of the Discovery effort were sufficiently broad in scope to identify the causes and extent-of-condition of prior weaknesses. These assessments, combined with the associated corrective action, provide reasonable assurance that safety related SSC's will perform their intended safety and accident mitigation functions (as described in the design and licensing bases) at restart.

Although this document provides some perspective on the safety consequences derived from the Discovery effort, I&M's focus has been and continues to be on thorough identification of problems, developing sound solutions, and ultimately implementing corrective actions that will move the plant, programs and personnel to safe, reliable operation.

## **Discovery Oversight**

Oversight of the Restart process is an essential element to providing reasonable assurance that the CNP units will be safely restarted and reliably operated. The CNP Performance Assurance organization has been continuously involved in assessing the Discovery phase of the Restart process. By

## **Fixing the Plant**

both internal and external standards, Performance Assurance has been intrusive and effective in its oversight efforts. Through these efforts, Performance Assurance has determined that the Discovery process has been effective.

The Discovery Phase of restart has been essentially complete and the Implementation Phase (the fix-it phase) has commenced. Discovery of emerging issues, however, continues through implementation and beyond. As described above, I&M has identified problems in the areas of plant, process and personnel. The key infrastructure programs, such as the Corrective Action Program, Design Control Program, and Safety Evaluation (*i.e.*, 50.59) Program and the Work Control Process, have been upgraded and are showing signs of improvement. Personnel are demonstrating improved ownership and teamwork. These encouraging results will support the move forward to fix the plant.

The Discovery Phase was led by Engineering. The Implementation Phase, and beyond, is being led by Operations. A critical step in this transition to implementation is to ensure that an appropriately structured team is ready to assume the Operations leadership role. An Operations Leadership Team has been assembled, under the Site Vice President, that consists of the Plant Manager (Restart Manager), and the Directors of Work Control, Plant Maintenance, Plant Engineering, and Operations Manager. These Team members all bring substantial experience in their areas of expertise.

*Quality will yield safety and reliability*

The Operations Leadership Team prioritizes and schedules the work. In addition, the Operations Department, through the shift supervisors, controls the execution of the work and thus acts as the safety conscience for the plant. With management focus on accountability (*i.e.*, ensuring adherence to management expectations and standards), the Operations Leadership Team's efforts should result in quality fieldwork.

The work is being accomplished during the Implementation Phase using a system window format. Under this approach, CNP takes entire systems out of service for work during specific time periods, rather than tagging out individual components. To support this process and as a first step to ensuring safety, CNP off-loaded the cores for Units 1 and 2. This approach permits Operations to focus on the systems

critical to spent fuel cooling and allows maintenance and construction personnel greater freedom to perform the work on the remaining equipment, on a system-wide basis.

Upon completing the work, the systems are tested and returned to service in an order that supports advancing modes of operations (e.g., the systems needed for Mode 5 will be returned to operations prior to the systems to support Mode 2). Operations and management review the work completed on each system and Operations makes a determination that the system is in sufficient material condition for the system to be returned to service. The Plant Operating Review Committee (PORC) is a part of this review process. This approach improves operational focus through a reasoned, systematic implementation process.

While CNP has made and continues to make progress, challenges remain ahead. The ultimate goal is to become a World Class Performer, which is defined as top quartile performance. Achieving this will take time. A foundation is being built during the Restart Process. By restart, it is intended to have reasonable assurance that the plant, processes, and personnel will be ready to operate the units in a safe and reliable manner.

## **Conclusion**

The Discovery process has been comprehensive and rigorous, and this has been validated by the Performance Assurance organization. In summary:

- The Discovery process is essentially complete, resulting in thorough identification of the problems. In moving forward, the Corrective Action Program will be utilized to disposition emerging issues during restart and beyond.
- The Discovery process has investigated the extent-of-condition of deficiencies related to the pre-existing weaknesses. The Corrective Action Program is evaluating and resolving the specific identified problems.
- The problems found during Discovery fall into the following areas: (1) technical items; (2) deficient processes; and (3) ineffective management of personnel and processes.
- The Discovery process did not identify any new significant industry issues and many of the identified problems are similar to ones that have known corrective actions within

the industry.

- The combination of the Discovery process with the anticipated corrective actions taken to address identified problems and the extent of condition, will provide reasonable assurance that the plant SSCs, supporting processes and personnel at CNP are ready for a safe and reliable restart and operation of the units.

***Engineering Improvement***

We believe that the Engineering organization has demonstrated leadership qualities in its ability to manage the complex Discovery process (e.g., ESRR). As we move forward with fixing the plant, they will be called upon to further demonstrate their skills through successful resolution of identified problems, support for material condition fixes and design changes in the plant, and support of operations during restart and operations.

***Operations Led***

Likewise, as we continue through the Implementation Phase and beyond, we will demonstrate the credibility and leadership of the Operations organization. The implementation of the corrective actions identified through the Programmatic and Functional Area Assessments will largely be led by Operations.

***Organization is demonstrating progress***

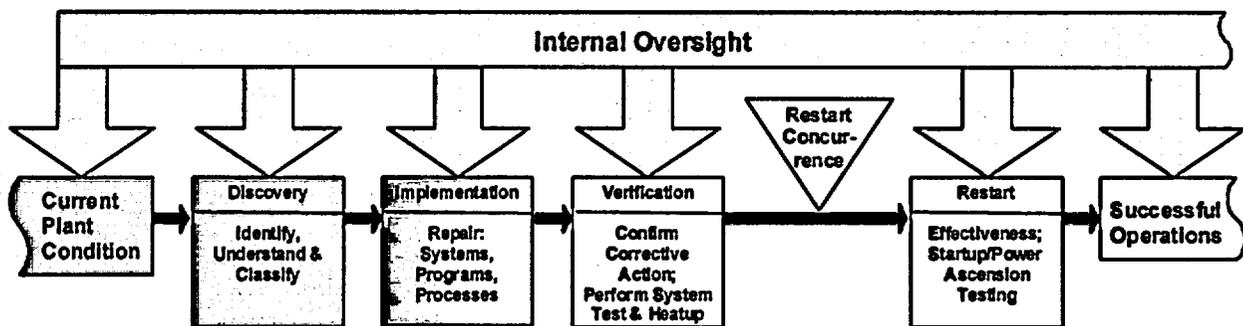
The processes and personnel continue to show signs of strengthening. A top priority is to continue the focus on safety. This will be achieved through comprehensive planning, effective execution of corrective actions and effective oversight.

## Attachment

# Overview of Restart Process

### Overview of the Restart Process

As explained in the CNP Restart Plan, Revision 5, the restart process has been divided into four phases: (1) Discovery; (2) Implementation; (3) Verification; and (4) Startup and Power Ascension. The four phases are accompanied by continuous internal oversight. The phases leading to restart are summarized below.



### Discovery Phase

Discovery is the process of identifying and classifying plant, personnel, and process issues that can challenge safe and reliable operation of CNP. The primary drivers of Discovery are ESRR and the functional area and programmatic assessments. Together they establish the extent of condition of problems identified in the NRC inspections and I&M sponsored assessments (that led to the extended outage), and to ensure that appropriate corrective actions are completed to address the full extent of condition of these problems.

### Implementation Phase

Implementation is the completion of the designated restart required corrective actions to a standard that provides reasonable assurance of successful restart. Integrated work scheduling is needed to prioritize and allocate resources for corrective action implementation and monitor accountabilities of assigned work.

### Verification Phase

Verification includes final readiness reviews that are intended to confirm the completion and adequacy of restart activities. These reviews will be conducted to confirm the readiness of structures, system and components, and functional area and programmatic readiness. Self-assessments, third-party evaluations, peer reviews, and other verification methods will

be used as directed by departmental and senior management.

In addition, the restart readiness process requires an affirmation that attests that there is reasonable assurance that restart actions have been complete to facilitate safe and reliable startup and continued operations. The affirmation will be the foundation for continuous improvement. The Plant Operations Review Committee (PORC) will conduct readiness affirmation sessions and, through the Site Vice President, recommend restart to the Senior Vice President when appropriate. Following acceptance by the PORC, the Senior Vice President will authorize startup based on this review with input from Performance Assurance, the Nuclear Safety Design Review Committee and the Independent Safety Review Group.

**Startup and Power Ascension Phase**

Startup and Power Ascension includes system testing and related activities conducted during plant heat up, criticality and ascension to full power. These activities provide additional assurance of effective corrective action and readiness for restart. Emphasis will be placed on assuring that personnel, programs and equipment are performing as expected and as required.

**Internal Oversight**

Internal Oversight involves continuous assessment by the Performance Assessment organization of restart activities to provide further assurance that the work is done in accordance with regulatory requirements, plant procedures and management expectations.