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Docket Number 50-346

License Number NPF-3

Serial Number 1-1314

May 2, 2003

Mr. James E. Dyer, Administrator
United States Nuclear Regulatory Commission
Region III
801 Warrenville Road
Lisle, IL 60532-4351

Subject: Submittal of Revision 1 of the Root Cause Analysis Report Assessment of Engineering Capabilities", dated April 9, 2003

Dear Mr. Dyer:

On January 9, 2003 (Serial 1-1299), the FirstEnergy Nuclear Operating Company (FENOC) submitted several root cause analysis reports and assessments that were performed to thoroughly investigate and address organizational, programmatic and human performance issues that may have contributed to the RPV head degradation at Davis-Besse. Included in that submittal was the report entitled "Root Cause Analysis Report Assessment of Engineering Capabilities", dated January 3, 2003.

This report was subsequently revised to address issues identified during our internal Restart Readiness Review of Engineering that was conducted during the week of March 17, 2003. The purpose of this letter is to submit Revision 1 of the Root Cause Analysis Report Assessment of Engineering Capabilities, dated April 9, 2003 as an enclosure to this letter. This revision supercedes our earlier submittal in its entirety.

No commitments are identified in the enclosure. If you have any questions or require further information, please contact Mr. Patrick J, McCloskey, Manager - Regulatory Affairs, at (419) 321-8450.

Sincerely yours,

GB

Attachment
Enclosure

cc: USNRC Document Control Desk
J. B. Hopkins, DB-1 NRC/NRR Senior Project Manager
C. S. Thomas, DB-1 Senior Resident Inspector
Utility Radiological Safety Board

COMMITMENT LIST

The following list identifies those actions committed to by Davis-Besse Nuclear Power Station in this document. Any other actions discussed in the submittal represent intended or planned actions by Davis-Besse. They are described only as information and are not regulatory commitments. Please notify the Manager - Regulatory Affairs (419-321-8450) at Davis-Besse of any questions regarding this document or any associated regulatory commitments.

COMMITMENT	DUE DATE
None	N/A

Docket Number 50-346
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Enclosure

Root Cause Analysis Report
Assessment of Engineering Capabilities
Revision 1

April 9, 2003

(64 pages to follow)

FirstEnergy, DAVIS-BESSE NUCLEAR POWER STATION

Root Cause Analysis Report

Assessment of Engineering Capabilities, Rev. 1

CR 2002-07525, Dated 10-05-2002

REPORT DATE: 4-09-2003

Prepared by: David T. Woodfin

Approved by: ____________________
Director, Davis-Besse Nuclear Engineering Department

Approved by: Lew W. Myers
Vice-President, Davis-Besse Nuclear Power Station

Nuclear Engineering Department

Problem Statement

Description of reason for investigation

The investigations into the degradation of the Reactor Pressure Vessel Head revealed the existence of weaknesses in the organizational effectiveness of the Davis-Besse Nuclear Engineering Department (DBNED). Condition Report 02-07525 was initiated to document this condition, the investigation into the cause of these weaknesses and the corrective action to resolve them and prevent their recurrence. Symptoms of the weaknesses in the organizational effectiveness of the engineering department were documented in other Condition Reports that were rolled into this investigation. Therefore, the investigation and resolution of this condition report also addresses the conditions described in CRs 02-02434, 02-03668, 02-07813, and 02-08199.

CR 02-02434 documents examples of a marginal engineering analysis of concerns and issues. Until the investigation and corrective actions are in place, immediate actions to ensure interim engineering outputs are technically correct, that sound scientific methodology is applied and that all activities reflect professional engineering standards and ownership, are implemented. Weaknesses were identified at varied levels of management, indicating that rigor must be equally applied to reviews and approvals as well as the origination level.

CAF 02-02434-5 documents an action to rollover the investigation of the conditions identified in CR 02-02434 into CR 02-07525. Since CR 02-07525 addresses the generic human performance weaknesses within the Nuclear Engineering Department, the investigation also addresses the root cause of less than adequate engineering analysis of concerns and issues.

CAF 02-02434-3 documents an action to rollover the investigation of the conditions identified in CR 02-03005 into CR 02-02434. Since CR 02-02434 was rolled into CR 02-07525, the investigation into the conditions in CR 02-03005 will be part of the cause analysis of CR 02-07525. CR 02-03005 documents that a less than adequate operability determination was prepared and approved for CR 02-02869 (Diesel Fire Pump). The issues were inadequate rigor and inaccurate statements regarding vendor concurrence. Since adequate rigor would involve validating the technical information used to make the determination, the issue of inaccurate statements regarding vendor concurrence becomes secondary and will not be addressed in this investigation, although an immediate action was initiated to clarify expectations in this area. However, the appropriate application of accountability addresses both of these issues.

CR 02-03668 identified that a history of persistent leakage exists at the casing-to-cover joint for Reactor Coolant Pumps (RCP) 1-1, 1-2, 2-1, and 2-2. Failure to adequately address this chronic leakage issue in a timely manner is contrary to FENOC Engineering Principles and Expectations # 3. The cause was determined to be the low expectations and standards and a general willingness to accept RCS leakage by engineering.

CR 02-07813 identified that long term and ongoing mandatory work-hour schedules, typically involving 60+ hours per week and 12+ hour days, were adverse to the safety and well being of employees and that the consequences of this work environment potentially degrading fitness-for-duty while performing safety-related activities could affect the health and safety of the public.

CR 02-08199 identified that numerous examples existed of issues that were known but not properly addressed; of giving and accepting the easy and often the wrong answer; and of inadequate, untimely, and erroneous corrective actions. These allude to the fact that the organization does not have a full understanding or appreciation of the root causes associated with the RPV Head Degradation (CR 02-00891) and has not made the transition yet to an organization with a questioning attitude.

These condition reports document evidence that weaknesses in the organization effectiveness exist and raise questions regarding the capabilities of the Davis-Besse Nuclear Engineering Department to support the safe and reliable operation of the Davis-Besse Nuclear Power Station.

Consequences of event/condition investigated

The failure of the Davis-Besse Nuclear Engineering Department to adequately identify and resolve issues concerning the safe operation of the Davis-Besse Nuclear Power Station directly contributed to allowing the degradation of the Reactor Pressure Vessel Head to occur. The investigation of the management and human performance aspects of this failure is documented in the Root Cause Analysis Report entitled "Failure to Identify Significant Degradation of the Reactor Pressure Vessel Head", dated 8/13/02.

That investigation was focused on the management and human performance issues associated with the failure to identify the corrosion of the RPV head. The investigation found that there was a lack of sensitivity to nuclear focus and a tendency to justify the existing conditions. The overall conclusion was that management ineffectively implemented processes and thus failed to detect and address plant problems as opportunities arose. Although it was expected that the corrective actions assigned would address weaknesses in the Engineering organization and prevent like events from occurring, further evidence indicated that there were pervasive weaknesses in the organizational effectiveness of the organization and additional investigation was warranted. The evidence is documented in the initiation of the above Condition Reports.

These conditions represent the failure of the engineering organization to properly support safe and reliable plant operation and to foster improvements in plant performance, efficiency, and reliability by optimizing overall engineering support. Therefore, it was deemed likely that other generic weaknesses exist and an investigation should be performed to determine how the Davis-Besse Engineering organization functions in comparison with engineering organizations that are performing well. Corrective actions can then be developed and implemented to ensure the organization begins and continues to function as a top performing engineering organization in support of safe and reliable plant operation.

Immediate actions taken

1. The Engineering Assessment Board was strengthened and assigned to review the primary products (all modifications and any other products requested by management) of the DBNPS Nuclear Engineering Department and provide feedback to the individual preparer(s). This review is intended to ensure the necessary engineering rigor and standards are utilized in the development, review and approval of engineering products.
2. The Director – Nuclear Engineering issued memo NSS-02-00005, "Control of Vendor Technical Interfaces," on July 22, 2002 to clarify expectations in the subject area.

Remedial actions taken

1. The Management and Human Performance Improvement Plan was developed prior to the initiation of this condition report to address the previously identified management and human performance issues. The corrective actions assigned to resolve these issues address some aspects of the weaknesses of the DBNPS Nuclear Engineering Department.
2. A team of industry leaders was assembled and tasked with assessing the current status of the DBNPS Nuclear Engineering Department capabilities and making recommendations for improvements. These recommendations provide near term as well as long-term resolutions to the identified weaknesses.

Remedial actions proposed

1) Recruit and fill key manager and supervisory positions in the engineering organization.
2) Hold teambuilding session for Davis-Besse Engineering supervisory personnel.
3) Coordinate the initial meeting of Engineering Supervisors for the communication of behaviors/expectations for FENOC Engineering.
4) Standardize the Davis-Besse Engineering organizations and functions consistent with the FENOC model.
5) Develop proposed vision, roles and responsibilities for the engineering organization.
6) Obtain agreement with and support from station counterparts that the proposed roles and responsibilities are right and that the entire site organization will support them.
7) Develop communication plan on the revised engineering roles and responsibilities.
8) Approve communication plan for revised FENOC roles and responsibilities.
9) Communicate new organizational roles and responsibilities.
10) Fill open position for Engineering Training Instructor.
11) Develop and implement training plan on revised engineering roles and responsibilities.
12) Identify and modify process, procedure and program constraints that conflict with the desired engineering roles and responsibilities.
13) Reinforce individual accountability and performance through utilization of FENOC ownership for Excellence process.
14) Develop staffing and qualification plan to fill existing organizational gaps to the standard structure, including operations and maintenance personnel in the potential pool of candidates with special consideration to ensure sufficient plant specific, PWR and operational experience exists in the engineering organization.
15) Develop succession plan down to the supervisor level in engineering, targeting individual contributors to receive leadership and supervisory training prior to assuming positions. Include targeted rotation inside and outside of engineering in the plan.
16) Coordinate the development of succession plans at Davis-Besse with FENOC wide succession planning activity.
17) Present options for improving the operational focus of technical personnel to the training council such as utilizing the Senior Reactor Operator Certification and License Program.

18) Ensure the resolution of deficiencies required for Davis-Besse restart is complete.

Event Narrative

The events leading to the discovery of the degradation of the Reactor Pressure Vessel Head at the Davis-Besse Nuclear Power Station are documented in the Root Cause Analysis Reports associated with Condition Report No. 02-00891. The first report, titled "Significant Degradation of the Reactor Pressure Vessel Head," Revision 1, and dated 8/27/02, deals with the technical causes of the event. The second report, titled "Failure to Identify Significant Degradation of the Reactor Pressure Vessel Head", and dated 8/13/02, deals with the management and human performance issues that allowed the event to occur and progress to the extent that it did.

Several related issues, identified during the extended outage, have been documented in condition reports dealing with the management and human performance aspects of the functioning of the Nuclear Engineering Department. These issues are also addressed by the results of this investigation.

CR 02-02434 identified that a review of historical condition reports linked to the degradation of the RPV head indicated a marginal engineering analysis of concerns and issues. The CR recommended that immediate compensatory measure be instituted to ensure the outputs of the engineering organization are technically correct, that sound scientific methodology is applied, and that all activities reflect professional engineering standards and ownership. Additionally, since weaknesses were evident at varied levels of management, the measures should be applied to reviews and approvals as well as to the origination of these products. The Engineering Assessment Board (EAB) was strengthened with senior industry consultants in recognition of this concern. The conditions identified by this CR were forwarded to the root cause team investigating the management and human performance issues related to the RPV head degradation to determine what influenced these behaviors.

CR 02-03005 identified less than adequate rigor in the development of an operability determination on the Diesel Fire Pump by engineering. Additionally the assumption of vendor concurrence was not based on stated facts. The immediate actions taken for the conditions identified in CR 02-02434 also apply to the less than adequate rigor. The expectations documented in the memo from the Direct – Nuclear Engineering addressed the immediate concern with vendor technical interfaces.

CR 02-03668 identified that the chronic leakage at the Reactor Coolant Pumps' casing-to-cover joints was not addressed in a timely manner. This is contrary to the FENOC Engineering Principles and Expectations to be intolerant of failures of critical equipment. The leakage was first identified in 1996 but only recently was the cause determined and the appropriate corrective action, an Engineering Change Request, initiated.

CR 02-07525 identified that, during it's review of the Management and Human Performance Root Causes for the Reactor Pressure Vessel Head degradation event, the NRC questioned how the shortcomings in the engineering support of proper resolution of issues surrounding the event were going to be addressed. In response, Senior FENOC Management acknowledged that weaknesses in Engineering had been an area of concern and that actions had been taken, even before the head degradation had been found. Management agreed that an assessment of the current Engineering capabilities would be formally documented and the actions taken in response to identified weaknesses would be assessed to ensure their adequacy for plant restart.

CR 02-07813 identified an apparent lack of management concern for the safety and well being of employees due to the use of an elevated amount of overtime. The initiator expressed safety, health and efficiency concerns that the current work schedules could have adverse effects on employees and the successful restart and safe operation of the facility. The initiator met separately with the Manager of the Design Engineering Section and the Director of Engineering who discussed the concerns and explained the implementation of the administrative controls on use of overtime and the observation practices used to monitor personnel. The current status of the plant will continue to require the use of overtime and management is aware of the impact this has on employees. Therefore, there is a heightened sensitivity to the impact of the extended outage on personnel physical, mental and emotional welfare and management is monitoring performance indicators to ensure the health and safety of the public as well as plant personnel is maintained. This root cause analysis is focused on the Engineering Department, while the use of overtime affects the personnel in all station departments. Condition Report 03-01853, which was initiated to document the need to revise this root cause analysis, will address the effect that the current use of overtime may have on the personnel in all station departments.

CR 02-08199 identified that the NRC reported the discovery of numerous examples of the Davis-Besse organization not addressing known issues; developing and accepting the easy, and often incorrect, resolution to issues; and providing inadequate, untimely, and erroneous corrective actions for issues. These statements were interpreted as alluding to a lack of full understanding or appreciation of the root causes associated with the RPV head degradation and not making the transition to an organization with a questioning attitude.

Permanent and interim measures have been instituted to correct or compensate for these identified weaknesses. A new management structure, along with new management personnel, has been instituted. The Engineering Assessment Board was strengthened with industry expertise and policy NOPL-CC-0001, "FENOC Engineering Principles and Expectations," was developed and issued. A Return to Service Plan was developed to provide the course of action for the plant's safe and reliable return to service.

This course of action includes those actions necessary to address each of the commitments in the NRC Confirmatory Action Letter (CAL) regarding the RPV head degradation; the near-term corrective and preventive actions necessary to address the causal factors associated with the RPV Head degradation event; and the long-term actions necessary to assure that the underlying causal factors remain corrected and the continued safe performance of the Davis-Besse Nuclear Power Station can be sustained. In addition, the root cause(s) related to management not promptly identifying the degradation of the RPV Head will be corrected.

This plan consists of seven Building Blocks, designed to support safe and reliable restart of the plant and to ensure sustained performance improvements:

A. Reactor Head Resolution Plan

B. Containment Health Assurance Plan

C. System Health Assurance Plan

D. Program Compliance Plan

E. Management and Human Performance Excellence Plan

F. Restart Test Plan

G. Restart Action Plan.

The Return to Service Plan and its' associated component plans will address the aspects related to the RPV Head degradation event, the causal factors leading to the occurrence of the event and provide assurance that a similar event will not recur in the future. One of the issues, identified as a significant contributor to the event, was the lack of adequate support for safe and reliable operation by the Davis-Besse Engineering Organization. To address this issue, as well as improve the overall standards and efficiency of the First Energy Nuclear Operating Company (FENOC) Engineering Organization, a corporate policy to focus on ensuring that FENOC Engineering standards were consistent with the best in the industry was developed. This standard was published as Nuclear Operating Policy, NOPL-CC-0001, FENOC Engineering Principles and Expectations, and distributed as a handbook to FENOC Engineering employees. Engineering Department and Section meetings were held to discuss these principles; develop an understanding of their meaning; and encourage their incorporation into the culture of the Engineering organization.

A new Engineering organizational structure was also developed that incorporated some functions into a central FENOC Corporate Engineering Organization to provide support to all the FENOC sites and also standardized the Engineering organizational structure at each FENOC site. The implementation of this new organizational structure will necessitate relocation for some personnel and new assignments for others. These organizational changes, as well as promotions, personnel actions and other attrition, have resulted in various personnel openings in management and supervisory positions in the DBNPS engineering organization. Recruiting for these positions is ongoing, however, the following positions have been filled at this time:

- Manager, Plant Engineering
- Supervisor, Components and Materials
- Supervisor, Structural Mechanics
- Supervisor, Engineering Work Management
- Supervisor, Configuration Management
- Supervisor, Document Control
- Supervisor, Rapid Response Team

The following positions are filled by contract or acting individuals and require permanent assignments:

- Supervisor, Predictive Maintenance and Reliability
- Supervisor, Mechanical Design

On several cases, the ongoing outage organization assignments have delayed the new supervisors from effectively taking their positions, most notably the Supervisors of Components and Materials and the Rapid Response Team.

Data Analysis

DATA REVIEW

There are several approved methodologies available for performing root cause analysis. Proven methods vary in technique and the type of problem for which they can be most effective. The Human Performance Enhancement System (HPES) process addresses ways that human performance affects personnel when their actions cause or contribute to a problem. Developed by INPO, the selection of the correct causal factors for a human performance problem is dependent upon the Analyst determining the internal and external factors that affected the behavior of the individual. The method is implemented by categorizing human performance conditions, causal factors, and contributing factors. The Performance Improvement International (PII) Stream Analysis is used to determine root cause(s) from a list of symptoms. This method is useful since it looks at the big picture and assesses all aspects of problem. The PII Organizational Culture Assessment is useful for assessing specific attributes of an organization and provides clear guidance as to good characteristics of a specific attribute. To be effective, both of the PII assessment methods require specific knowledge of the process. The method used for this root cause analysis was to have subject matter experts with industry leadership credentials perform an assessment of the organizational effectiveness of the Davis Besse Nuclear Engineering Department and identify weaknesses in the organization. These weaknesses were treated as symptoms to determine the root cause using the HPES categorization methodology.

To ensure objectivity in the assessment, current and former Davis-Besse personnel were excluded from the investigation team and the Institute of Nuclear Power Operations was requested to facilitate an Industry Assessment of Engineering at Davis-Besse. The assessment of the DBNPS engineering organization was performed from December 9-13, 2002 by an independent industry team that included senior nuclear industry engineering leaders. The team's objective was to evaluate the organizational effectiveness of the DBNPS engineering organization and the capability of the organization to support safe plant operations and to identify any areas for improvement particularly focused over the long-term.

The team identified a need to focus on building and maintaining a solid engineering organization. Specifically, the team identified weaknesses in the following areas:

- Engineering Organization
- Engineering Roles and Responsibilities
- Staff Development
- Learning Organization
- Resolution of Open Items
- Engineering Assessment Board
- Owner Acceptance of Vendor Products
- Work Management
- Performance Monitoring

The assessment report documented the following results of the review performed of the organizational effectiveness of the Davis-Besse Nuclear Engineering Department and provided recommendations for improvement to address the identified weaknesses:

Davis-Besse has been shutdown for approximately 10 months at the time of this assessment. Substantial progress has been achieved in the building block programs by providing focused project management as well as contract resources. This short-term focus on the extent of condition from the causes and contributors to the reactor vessel head degradation event has held management's attention (appropriately). Renewed focus on building and maintaining a solid engineering organization over the long-term is now needed.

The following provides further elaboration on the areas reviewed.

A. Engineering Organization

Although the engineering leadership team is not in place, positive steps were taken to establish the leadership team with the recent movement of experienced company personnel into the director – nuclear engineering, manager – design basis engineering, and manager – projects positions. However, significant weaknesses exist with first-line supervisor ranks. Two of four plant engineering supervisor positions are vacant with one of the two remaining supervisors temporarily assigned to restart activities. Two of four supervisor positions in design engineering are vacant. Also, the manager – plant engineering is moving to a new position. The mechanical system design organization has significant vacancies. The first and arguably most important step to full organizational recovery is to select and fill these positions. The absence of leaders in these positions fosters organizational misalignment low morale, misinformation and the reduced ability to coordinate work within the station. In many groups, engineers do not receive necessary coaching, technical guidance, or reinforcement of expected behaviors.

B. Engineering Roles and Responsibilities

Substantial information was evident to suggest that clear roles and responsibilities for engineering either do not exist or are misunderstood. For example, many people interviewed questioned the engineering involvement in day-today maintenance activities. There is a strong need to implement the following:

1) clearly define the roles and therefore the accountability of each engineering department/section; and

2) work with senior management, other station organizations, and the engineering organization to gain acceptance and support for these roles.

Also, the Davis-Besse organization is different from the other FENOC engineering organizations. The station should adopt the FENOC standard organization for engineering as soon as possible. It is the team's judgement that rebuilding the engineering capability at Davis-Besse takes precedence over staffing engineering functions in the proposed corporate organization.

Teamwork and alignment of purpose, both internal to engineering and among departments, will be key to long-term success. Recommendations are included for engineering management and supervisory personnel to retreat from the site to develop the items spelled out above and come together as a management team. They should work together to articulate what a healthy, well-functioning engineering organization looks and feels like. They should develop a renewed sense of commitment to lead engineering to achieve its future vision and support each other as they work to achieve that goal.

It will be important for the proper level of engineering management to be represented, together with counterparts in other organizations, at all key leadership activities. Site

leadership needs to be consistently supportive and offer positive, constructive feedback as engineering seeks to improve.

C. Staff Development

With the engineering team in place, emphasis needs to be on performance management of engineering personnel. A good first step has been taken with development of engineering principles and expectations. The entire staff needs to become ingrained with and live up to these principles and expectations. Engineering management, in meetings and other interactions with the engineering staff, should set the example and live up to these expectations and principles.

D. Learning Organization

Emphasis also needs to be placed on making engineering a learning organization. The lessons learned from the ongoing engineering review and assessment activities are not being captured and cataloged for use by FENOC personnel. Several good practices have been implemented, such as the Engineering Assessment Board (EAB) and the systematic reviews or programs and plant systems; however, feedback to the engineering training program is not provided to ensure all appropriate engineering personnel learn from these activities. Minimal participation in external industry activities can lead to an isolated organization. Therefore, a plan is needed to force appropriate involvement.

E. Resolution of Open Items

The discovery phase in each area under engineering cognizance (containment health, system health and latent issue reviews, and program reviews) is coming to completion. Containment health has evaluated the impact of the reactor coolant system leaks on systems and components within the containment building. System readiness reviews have determined the current statuses of the systems, as well as refreshed the system engineers on the systems. Open issues have been cataloged through latent issue reviews for selected systems and by other system design reviews. Engineering programs have been assessed and open issues require resolution to ensure sustained improved performance.

Many of the deficiencies identified from these reviews were known and documented prior to the event at Davis-Besse but were not corrected. Regardless of the reasons for failure to follow through on these open items in the past;

1) a program should now be defined that properly evaluates each item based on plant impact and potential risk;

2) schedules for completion of the outstanding items should be developed based on risk significance; and

3) resources should be dedicated over the next few years to fully complete this effort

Station Management must understand the importance of closing out open design items and implementing configuration management programs properly to prevent repeating these problems.

F. Engineering Assessment Board

The EAB was established as an interim compensatory measure to ensure:

1) the outputs of the engineering organization were technically correct,

2) that sound scientific methodology was applied, and

3) that all activities reflected professional engineering standards and ownership.

This constitutes a process barrier that needs to transition to a true assessment board, with the objective of raising the quality standards of all engineering products. The board membership needs to be representative of the engineering organization with clearly defined roles and responsibilities and qualification requirements.

G. Owner Acceptance of Vendor Products

The large volume of contracted services has demonstrated a weakness in the process for review and acceptance of vendor products at DBNPS. The expectations for the review and acceptance of vendor products are unclear, contributing to inconsistent reviews and high backlogs of products requiring review by Davis-Besse personnel. Opportunities exist to conduct these reviews more efficiently and effectively by better defining the scope of work and conducting in-process reviews. The typical review resources in the industry can be 10-15% of the total project resource requirements.

H. Work Management

Engineering lacks an effective work management process to enable appropriate prioritization and management of engineering resources. This condition has resulted in work inefficiencies, frequent priority changes and, in some cases, disconnects between the station and engineering priorities.

I. Performance Monitoring

Management lacks effective tools for monitoring and trending the performance of the engineering organization.

FACT LIST

1. Key leadership positions in the engineering organization are vacant or staffed with temporary personnel.
2. Roles and responsibilities of engineering personnel are not clearly defined.
3. The Davis-Besse engineering organizational structure is different from other FENOC sites.
4. Performance management and hence accountability is not evident in the engineering organization.
5. Engineering does not emphasize being a learning organization.
6. Backlog of open engineering issues exists from prior to the head degradation event.
7. Engineering Assessment Board is a reactive process barrier.
8. Volume of contracted vendor products exists that require owner review and acceptance.
9. An effective engineering work management process does not exist.
10. Effective tools for monitoring and trending engineering performance do not exist.

CAUSAL FACTORS

The HPES Causal Factors Analysis (see Attachment C) identified the following:

Less than adequate managerial methods, the processes used to control or direct work-related plant activities, including how manpower and material is allocated for a particular objective, is the primary cause of the condition identified in the problem statement. All of the elements that make up this causal factor are represented in the analysis of these conditions.

Management Directions:

a. Policy guidance/management expectations were not well defined or understood. This was identified by the root cause analysis report of the management and human performance issues contributing to the reactor pressure vessel head degradation (CR 02-00891) and initially addressed by the promulgation of the FENOC Engineering Principles and Expectations Policy (NOPL-CC-0001).

b. Job performance standards were not adequately defined. The review of the published roles and responsibilities of the various engineering sections' personnel (procedures, programs and policies) and interviews with engineering and station personnel revealed disagreement or lack of understanding of the work groups and the documentation.

c. Personnel exhibited insufficient awareness of the impact of actions on nuclear safety or reliability. The evidence in the root cause analysis report on the management and human performance issues associated with the reactor pressure vessel head degradation (CR 02-00891) documents the existence of this symptom.

Management Monitoring:

a. Management follow-up or monitoring of activities did not identify problems. CR 02-02434 documents that management either did not identify the existence of the reactor vessel head degradation or chose to not follow-up on the evidence presented that a potential problem existed. This type of management performance was also evident in the response to the findings from NQA Audits and Surveillances and Engineering Self-Assessments, since many of the problems discovered during the recent reviews were previously documented but either ignored or given minimal attention.

Management Assessment:

a. Causes of a previous event or known problem were not identified. A lack of depth in previous cause analyses has been identified as a weakness in the Corrective Action Program. The review of CRs documented by NQA in CR 02-02434 indicates the prevalence of this symptom and a weakness in the performance management of engineering personnel.

b. Previous industry or in-house operating experience was not effectively used to prevent problems. The evidence from the investigation of the reactor vessel head degradation indicates that a large volume of operating experience information existed on the corrosion of reactor coolant system components from boric acid leakage. This evidence was not given the appropriate credence to establish the probability of the head degradation. An assessment by the Institute of Nuclear Power Operations also indicated weaknesses in the use of Operating Experience and recent Program Compliance Reviews discovered the need for additional improvements in the implementation of the Operating Experience Program.

Accountability:

a. Responsibility of personnel was not well defined or personnel were not held accountable. The absence of personnel in key leadership positions and lack of clearly defined roles and responsibilities has fostered organizational misalignment, low morale, misinformation and the reduced ability to coordinate work within the station. In many groups, engineers do not receive necessary coaching, technical guidance, or reinforcement of expected behaviors. This has resulted in personnel not knowing what they should be doing and thus not being held accountable for poor performance.

Corrective Action:

a. Response to a known or repetitive problem was untimely. Corrective actions for known or recurring problems were not performed at or within the proper time. The identification of the conditions reviewed by NQA in CR 02-02434 is evidence of this symptom.

b. Corrective action for previously identified problem or previous event cause was not adequate to prevent recurrence. Management failed to take meaningful corrective action for consequential or non-consequential events. The response to the corrosion of valve RC-02 (CR 02-06505) is one example of inadequate corrective actions.

c. Inadequate implementation of corrective actions. Although effective corrective actions were determined, the actions were not properly implemented resulting in ineffective corrective actions. The examples cited in CR 02-08199 are evidence of this symptom of inadequate managerial methods.

CONCLUSION

The data analysis indicates that inadequate managerial methods have resulted in the deterioration of the organizational effectiveness of the Davis-Besse Engineering Department and reduced the capability of the department to support the safe and reliable operation of the plant. NOBP-LP-2011, FENOC Root Cause Reference Guide, states that the HPES Causal Factors and the HPES Equipment Performance Causal Factors can be used by the root cause investigator to specify the root cause(s). However they do not provide a one-for-one correlation to existing approved trends codes that must be used within the FENOC Condition Report process. When referring to, or using the Causal Factor Categories, the evaluator / analyst must make the best correlation possible, and select the code(s) that best reflect the selected Causal Factors and sub-categories. Consistent evaluation methodology, cause coding, and trending provides a systematic process that identifies recurring root causes that create problems or causes with generic implications. The general category Management/Supervisor Methods (CREST Trend Code H00) is not considered specific enough to assign as a root cause, therefore management expectations not communicated or worker accountability not at desired level (CREST Trend Code H04) was selected as the root cause.

The following is presented to validate the conclusion that this investigation and associated corrective actions address the issues identified in the Condition Reports that were rolled over to this Condition Report:

CR 02-02434 identifies marginal engineering analysis of concerns and issues. The recommended corrective actions direct the development of clearly defined roles and responsibilities for engineering personnel; training to ensure the needed knowledge and skills are available to accomplish these roles and responsibilities; schedules to ensure the required work assignments are properly assigned and completed; and performance indicators to measure the quality and timely completion of the assigned work. This will ensure that engineering personnel know what

they are supposed to do, how they are to accomplish these tasks, and when to accomplish these tasks. The performance indicators will provide management evaluation tools to determine if their expectations are being implemented and allow for the proper evaluation and resolution of any deficiencies. These corrective actions should ensure engineering analysis of concerns and issues are adequate to support safe and reliable operation of the plant and address the condition identified in CR 02-02434.

CR 02-03005 identifies less than adequate rigor in the development of an operability determination by engineering and failure to proper validate information through a vendor technical information interface. A memo was issued by the Director – Nuclear Engineering to provide expectations for the control of vendor technical interfaces. The establishment of consistent policies in principles and expectations (NOPL-CC-0001, FENOC Engineering Principles and Expectations) and roles and responsibilities (NOPL-CC-0002, FENOC Engineering Roles and Responsibilities); the analysis of personnel qualifications and training requirements for the new roles and responsibilities; the implementation of work management tools to ensure adequate resource management; the development of performance indicators to measure the quality and timeliness of engineering work products; and the enforcement of personnel accountability through performance management will ensure the expected rigor is present.

CR 02-03668 identifies low expectations and standards and a general willingness of engineering to accept RCS leakage as a condition of operation. The corrective actions recommended by this investigation will correct the low expectations and standards and eliminate the willingness of engineering to accept RCS leakage. The development of the FENOC Engineering roles and responsibilities will assign accountability for certain functions to specific segments of the engineering organization. Personnel will be provided the training (skills and knowledge) to implement these functions. Performance indicators will be established to measure the degree to which personnel are successful in implementing the functions assigned. The expected performance will be enforced through the proper use of accountability.

CR 02-07813 identifies a concern that the use of an elevated amount of overtime endangers the health and safety of plant personnel and the general public. The enforcement of the FENOC Fitness for Duty Program ensures that continuous behavior observation of all personnel is maintained. Management attention to trends in the occurrences of industrial safety incidents and personnel illnesses also provide short term compensatory actions for the necessary use of overtime during the extended outage. The Director of the DBNED and his staff discussed the effects of the use of elevated amount of overtime on department personnel in light of the requirements of the FENOC Fitness for Duty Policy and NRC Regulatory Issue Summary 2002-07, Clarification of NRC Requirements Applicable to Worker Fatigue and Self-Declarations of Fitness-For-Duty. Directions were provided to continue the discussion with the first-line Engineering Supervisors to ensure that engineering personnel were properly monitored and protected. The corrective actions recommended by this investigation will address the long-term allocation of personnel resources. As individual's roles and responsibilities are defined, training is developed and presented, work is scheduled and implemented and performance indicators are used to measure work quality and timeliness, management will have more information as to the optimum workload for maximizing quality and production. This is will also allow planning for the long term solutions to proper staffing selection and help prevent the occurrence of extended outages and the need for the use of elevated amounts of overtime.

CR 02-08199 alludes that the organization does not have a full understanding or appreciate the root causes associated with the RPV Head degradation and has not made the transition to an organization with a questioning attitude. The recommended corrective actions to develop performance indicators from first line supervisors of engineering products based on the EAB checklist; to place emphasis on making engineering a learning organization by providing feedback to the training program from lessons-learned; to force appropriate involvement in external industry activities; to develop performance indicators that measure product quality and production; and to enforce accountability for compliance with the expectations of management will instill a questioning attitude and reinforce the lessons-learned from the investigation of the root causes of the RPV Head degradation.

The issues identified in the Condition Reports that were rolled into this investigation will be addressed by the recommended corrective actions. Although a separate causal analysis was not performed on each of these conditions (or events), the symptoms that were categorized into causal factors that led to the conclusions in the root cause determination of this investigation are similar in content and can be expected to result from the same root cause. Therefore, absent any evidence to the contrary, the same root causes are assigned and the recommended corrective actions are expected to prevent the recurrence of the conditions (or events).

Experience Review

A review was performed to determine if operating experience was available to indicate the previous occurrence of weaknesses in the organizational effectiveness of engineering organizations affecting the capabilities of the organization to support the safe and reliable operation of the associated plant(s). The keywords used for the searches were organizational effectiveness/engineering capabilities/assessment of engineering/human performance/engineering rigor. The review identified the following related issues:

Davis-Besse

A review of the CREST database for CRs initiated at Davis-Besse, where the investigation or corrective actions documented an assessment of, or a weakness in, engineering capabilities, revealed numerous issues dealing with less than adequate engineering rigor. The failure of engineering to adequately support the safe operation of the plant is documented in the root cause analysis report of the management and human performance issues contributing to the failure to prevent the degradation of the reactor pressure vessel head (CR 02-00891). Weaknesses in the performance of various engineering activities are also reported in other DBNPS CRs. While these are related issues, repeating them and incorporating their findings into this investigation will not add additional clarity but might cloud the specific issues being addressed in the investigation.

Nuclear Industry

The CREST databases for both the Beaver Valley Power Station and the Perry Nuclear Power Plant document organizational effectiveness reviews of engineering and associated corrective actions for improvement opportunities. Neither database documents a failure of their engineering organizations to support safe plant operation nor the other areas for improvement identified in this condition report.

A common feature of the nuclear power generating facilities that were placed on the NRC's watch list has been weaknesses in the capabilities of the associated engineering organizations. This has been documented in the INPO documents "Themes ("Warning Flags") From Recent Extended Shutdowns," and "Warning Flags -Precursors of Weak/Declining Engineering Performance." Most of the "warning flags" symptoms were determined to exist to some degree in the Davis-Besse Nuclear Engineering Department.

Conclusions

A critical assessment of the Davis-Besse Nuclear Engineering Department performance against the symptoms listed in the INPO documents would have alerted management to the declining performance indicators and their potential impact on the safe operation of the facility. However, it is unlikely that the results would have changed given the minimalistic nature of the culture that prevailed at the time.

Root Cause Determination

The following root cause and contributing causes resulted in the condition documented in the Problem Statement:

ROOT CAUSE

Less than adequate managerial methods being employed to control and direct engineering activities in support of plant operations is the primary casual factor involved in the decline in engineering capabilities. This is documented in the Attachment C, HPES Causal Factors Analysis, which compared the weaknesses in the engineering organizational effectiveness to the symptoms of potential causes.

The root cause analysis report of the failure to prevent the degradation of the reactor pressure vessel head (CR 02-00891) determined that the root causes of the event were less than adequate:

(1) nuclear safety focus;
(2) implementation of the Corrective Action Program;
(3) analyses of safety implication; and
(4) compliance with the Boric Acid Corrosion Control Procedure and the Inservice Inspection Program.

One of the preventive actions for the less than adequate nuclear safety focus was to utilize organizational development/effectiveness consultants to assist in developing actions for the Management and Human Performance Excellence Building Block. An assessment of the organizational effectiveness of the Nuclear Engineering Department by senior nuclear industry management personnel (i.e., subject matter experts) was not specifically assigned as a preventive action under CR 02-00891 for this root cause but the recommendations from the assessment will address similar weaknesses in the engineering organization. Therefore, the corrective actions assigned to address the weaknesses documented in this root cause analysis are in addition to the actions detailed in CR 02-00891 and the Management and Human Performance Improvement Action Plan.

Less than adequate managerial methods were employed in establishing the expectations of management and enforcing the accountability of workers at the desired level (CREST Trend Code - H04). This is evidenced by the following symptoms:

- Job performance standards were not adequately defined;
- Management follow-up or monitoring of activities did not identify problems;
- Personnel exhibited insufficient awareness of the impact of actions on nuclear safety or reliability;
- Policy guidance / management expectations were not well defined or understood; and
- Responsibility of personnel was not well defined or personnel were not held accountable

The lack of effective tools for monitoring and trending of the engineering organization's performance resulted in management not being cognizant of the extent of the deterioration in the engineering organization's capabilities.

CONTRIBUTING CAUSES

New management personnel and the implementation of improved engineering principles and expectations are addressing the weaknesses in the principles and expectations of previous

management and their contribution to the current state of the engineering department. This assessment has identified the following conditions that need to be improved to allow the organization to function as a top performing engineering organization.

Resource management was ineffective in that key management and supervisory positions remain open in the organization. (H01) Without qualified personnel in these key management and supervisory positions insufficient management and supervisory resources are available to provide needed supervision. Key positions in plant and design engineering are currently vacant, staffed with temporary personnel, or staffed with personnel not fully qualified. The lack of succession planning in engineering has resulted in posted supervisor positions with no or limited applicants. The absence of individuals in these leadership positions fosters organizational misalignment, low moral, misinformation, and the inability to coordinate work within the station.

The planning, assignment, scheduling, and monitoring of engineering tasks lacks an effective work management tool to ensure appropriate prioritization and management of engineering resources. (H02) This has resulted in tasks and individual accountability not being made clear to workers, job performance and self-checking standards not properly communicated, frequent job or task shuffling and, in some cases, disconnects between the station and engineering priorities.

It is clear the engineering team recognizes the importance of configuration management. However, a backlog of design deficiencies exists from building block reviews and from previous reviews and programs. Priority has not been given to complete these backlog items in the past. This is evidence of ineffective change management resulting from one or more of the following (H03):

- accuracy / effectiveness of change was not verified or not validated,
- change was not identifiable during task,
- change was not implemented in a timely manner,
- change-related documents were not developed or not revised,
- changes were not adequately communicated,
- vendor support of the change was inadequate,
- problem identification methods did not identify need for change, or
- risks and consequences associated with change not adequately reviewed or assessed

Engineering is not sufficiently capitalizing on the learning opportunities from the current station shutdown to improve processes and develop personnel. (I04) Engineering Assessment Board process improvements are needed to maximize board effectiveness. The EAB must transition from a process barrier to an assessment function with the objective of raising quality standards in engineering products. Examples are that leads for most of the major initiatives are with contract personnel, and feedback from Engineering Assessment Boards is not shared with the organization. Also, training opportunities are not routinely being identified to improve performance.

Extent of Condition

The extent that similar conditions may exist in other station departments is addressed by the functional area reviews being performed by those departments and is not addressed in this report. These self-assessments are also being directed by the Management and Human Performance Improvement Action plan and will determine if similar conditions exist in those departments.

Recommended Corrective Action

A Change Management Plan was developed to implement the reorganization of the Davis-Besse Nuclear Engineering Department in accordance with the FENOC Change Management Guideline. This plan has been modified to incorporate some of the corrective actions listed below and will be continually updated as scheduled activities are completed or new activities are added. The following addresses the specific corrective actions developed to address the conditions and causal factors identified in this investigation:

Key management and supervisory positions remain open in the organization. The absence of individuals in these leadership positions fosters organizational misalignment, low moral, misinformation, and the inability to coordinate work within the station.

CAF #5 Recruit and fill managerial and supervisory position vacancies. (H01)

NED J. Powers 04/17/03

CAF #6 Hold teambuilding session for Davis-Besse Engineering personnel. (H04)

NED J. Powers 03/12/03

CAF #7 Coordinate an initial meeting of Engineering Supervisors for the communication of behaviors/expectations for FENOC Engineering. (H04)

FE K. Pech 2/15/03

CAF #8 Standardize the Davis-Besse Engineering organization and functions consistent with the FENOC model. (H01)

NED J. Powers 04/13/03

The engineering organization's roles and responsibilities at the station are not clearly defined. This condition has impacted the ability of engineering and the station to efficiently process work, establish appropriate accountabilities and prioritize core-engineering functions.

CAF #9 Develop proposed vision, roles and responsibilities for the engineering organization. (H04)

VPES G. Leidich 2/13/03

CAF #10 Obtain agreement with and support from station counterparts that the proposed roles and responsibilities are right. (H04)

NED J. Powers 4/15/03

CAF #11 Develop communication plan on the revised engineering roles and responsibilities. (H04)

FE R. Wilkins 01/24/03

CAF #12 Approve communication plan. (H04)

VPES G. Leidich 01/27/03

CAF #13 Communicate new organizational roles and responsibilities. (H04)

NED J. Powers 4/17/03

CAF #14 Fill open position for Engineering Training Instructor. (H01)

TRAN M. Marler 01/24/03

CAF #15 Develop and implement training plan on revised engineering roles and responsibilities. (H04)

TRAN M. Marler 04/30/03

CAF #16 Develop a plan for the identification and modification of process, procedure and program constraints that conflict with the desired engineering roles and responsibilities. (H04)

NED D. Woodfin 04/15/03

Key positions in plant and design engineering are currently vacant, staffed with temporary personnel, or staffed with personnel not fully qualified. The lack of succession planning in engineering has resulted in posted supervisor positions with no or limited applicants.

CAF #17 Reinforce individual accountability and performance through utilization of FENOC Ownership for Excellence process. (H02)

NED J. Powers 04/30/03

CAF #18 Develop staffing and qualification plan for the organizational gaps, including operations and maintenance personnel in the potential pool of candidates with special consideration for plant specific, PWR and operational experience. (H01)

FE F. Giese 04/30/03

CAF #19 Develop succession plan down to the supervision level targeting individual contributors to receive leadership and supervisory training prior to assuming positions. Include targeted rotations inside and outside of engineering in the plan. (H01)

NED J. Powers 04/15/03

CAF #20 Coordinate the development of succession plans at Davis-Besse with FENOC wide succession planning activity. (H01)

FE F. Giese 04/30/03

CAF #21 Present options for improving the operational focus of technical personnel to the training council such as utilizing the Senior Reactor Operator Certification and Licensing Program. (H01)

TRAN M. Marler 06/30/03

Engineering is not sufficiently capitalizing on learning opportunities from the current station shutdown to improve processes and develop personnel. Examples are that leads for most of the major initiatives are with contract personnel, and feedback from Engineering Assessment Boards is not shared with the organization. Also, training opportunities are not routinely being identified to improve performance.

CAF #22 Assign FENOC leads to all contracted work to maximize transfer of knowledge. (I04)

NED C. Hawley 04/15/03

CAF #23 Strengthen the Engineering Training Program to incorporate current lessons learned (e.g., EAB feedback, CR feedback, observations, etc.) (I04)

TRAN M. Marler 01/31/03

CAF #24 Develop a plan to increase engineering personnel involvement and knowledge of industry activities including:

a. Benchmarking of other utilities,

b. Participation in industry working groups, and

c. Assessments at other utilities

Set expectation that best practices are incorporated into conduct of engineering. (I04)

FE K. Pech 04/01/03

Engineering Assessment Board process improvements are needed to maximize board effectiveness. The EAB must transition from a process barrier to an assessment function with the objective of raising quality standards in engineering products.

CAF #25 Capture and trend the results of EAB reviews for use by line management to develop corrective action to address these deficiencies. (I04)

NED H. Stevens 01/31/03

CAF #26 Ensure consistency with the FENOC corporate approach for the EAB. (I04)

FE W. Kline 01/31/03

CAF #27 Develop a plan for the transition of the EAB to station personnel and the evaluation of EAB membership. (I04)

NED H. Stevens 01/31/03

CAF #28 Ensure the transition plan is consist with the FENOC corporate approach for the EAB at all sites. (I04)

FE W. Kline 01/31/03

The expectations for review and acceptance of vendor products are unclear, contributing to inconsistent reviews and high backlogs of products requiring review by Davis-Besse personnel. Typical review resources in the industry are on the range of 10 – 15% of the total project resource requirements. Opportunities exist to conduct these reviews more efficiently and effectively by better defining the scope of work and conducting in-process reviews.

CAF # 29 Establish a standard directive (NOP) on owner's acceptance of contracted/vendor work. (H01)

FE W. Kline 01/31/03

CAF #30 Define interim deliverables for project management and mid-course direction for owner's acceptance. (H02)

NED C. Hawley 01/31/03

CAF #31 Incorporate improvements into NOP-CC-2003, Engineering Changes. (H02)

FE W. Kline 01/31/03

CAF #32 Establish performance indicators for measuring vendor performance. (H02)

FE T. Lentz 04/17/03

Engineering lacks effective work management to enable appropriate prioritization and management of engineering resources. This has resulted in work inefficiencies, frequent priority changes and, in some cases, a disconnect between the station and engineering priorities.

CAF #33 Develop the engineering work request and scheduling system that captures all critical engineering work and uses a simple priority system to decide actions. (H02)

FE K. Pech 06/30/03

CAF #34 Establish method for tracking and notification of activities directed by all engineering programs similar to surveillance activities. (H02)

FE K. Pech 06/30/03

CAF #35 Implement corporate standard for accessibility of engineering documents (i.e. ATLAS software). (H02)

FE Ken Pech 06/30/03

CAF #36 Implement a scheduling system for all engineering work that is integrated with the site schedule. (H02)

NED C. Hawley 07/30/03

CAF #37 Develop performance indicators that set goals and measure backlog, throughput and age. (H02)

FE K. Pech 08/30/03

It is clear the engineering team recognizes the importance of configuration management. However, a backlog of design deficiencies exists from building block reviews and from previous reviews and programs. Priority has not been given to complete these backlog items in the past.

CAF #38 Complete deficiency resolution required for Davis-Besse restart. (H03)

NA R. Schrauder 05/12/03

CAF #39 Develop a program to properly evaluate each item based on plant impact and potential risk such as using expert panel reviews. (H03)

NED C. Hawley 06/30/03

CAF #40 Develop a schedule for completion of the open items based on risk significance and the engineering organization's ability to be involved in the resolutions. (H03)

NED C. Hawley 06/30/03

CAF #41 Dedicate resources for the ultimate completion of the project on a long-term basis ensuring the issue is completely resolved. (H03)

FAM D. Eshelman 06/30/03

Management lacks effective tools for monitoring and trending of the engineering organization's performance.

CAF #42 Develop performance indicators with set goals for: (H04)

- Quality of engineering work,
- System and Program health, and
- Work Management.

FE T. Lentz 04/17/03

CAF #43 Ensure indicators are consistent throughout FENOC. (H04)

FAM D. Eshelman 03/05/03

CAF #44 Develop a FENOC NOP for the self-assessment program that critically assesses all key elements of engineering performance, programs and processes on a periodic basis. (H04)

FE K. Pech 04/30/03

CAF #45 Implement the NOP for the self-assessment program at Davis-Besse. (H04)

NED J. Powers 06/30/03

CAF #46 This corrective action is to ensure the investigation and corrective actions of this condition report address the conditions documented in CR 02-07813 regarding the safety, health, and efficiency concerns caused by the work schedules of engineering that constitute adverse effects on our employees, the safe operation of this facility and the successful restart of Davis-Besse. (N/A)

NED D. Woodfin 01/04/03

CAF #47 CR 02-08199 documents statements alluding to the fact that the Davis-Besse engineering organization does not have a full understanding or appreciation of the root causes associate with the RPV Head Degradation (CR 02-00891). The statements further allude to not having made the transition to an organization with a questioning attitude. A need to ensure that the assessment of engineering capabilities performed for CR 02-07525 included attributes on Human Performance and the assimilation of the FENOC Engineering Principles and Expectation into the everyday work practices of engineering personnel was expressed by the initiator.

Therefore, this corrective action is to document that the investigation and corrective actions for CR 02-07525 addresses the concerns expressed by the initiator of CR 02-08199. (N/A)

NED D. Woodfin 01/04/03

CAF #48 Perform a restart readiness review of Engineering. (N/A)

NED J. Powers 04/11/03

CAF #50 As a follow-up to CAF #23, include Engineering Support Training as a required member of the distribution for the EAB Meeting Reports as outlined in future Revision 3 of the EAB Charter. (I04)

NED J. Powers 07/31/03

CAF #51 As a follow-up to CA 23, add the requirement into the Training Team Charter (DBBP-TRAN-0008, Rev. 0) in both the TRC Agenda template and the Primary CRC Agenda template for the Program Owner (who is usually the Committee Chairman) to obtain trend reports from their respective Section CR Analyst for use in their respective Committee Meetings. (I04)

TRAN M. Marler 07/25/03

CAF #52 As a follow-up to CA 23, add the requirement into the Training Team Charter (DBBP-TRAN-0008, Rev. 0) in both the TRC Agenda template and the Primary CRC Agenda template for the Program Owner (who is usually the Committee Chairman) to obtain Observation Database reports for use in their respective Committee Meetings. (I04)

TRAN M. Marler 07/25/03

CAF #53 Verify implementation of Revision 3 to DBE-001 (EAB Policy) within 30 days of restart. (I04)

NED H. Stevens 07/31/03

CAF #57 Implement the action plan developed for Corrective Action #24 (I04)

FE K. Pech 08/06/03

CAF #59 Implement the plan for the identification and modification of process, procedure and program constraints that conflict with the desired engineering roles and responsibilities that was developed in CAF #16. (H04)

NED D. Woodfin 06/30/03

CAF #60 Implement the staffing and qualification plan for the organizational gaps that was developed in CAF #18. (H01)

FE F. Giese 06/30/03

CAF #61 Implement the succession plan that was developed in CAF #19. (H01)

NED J. Powers 06/30/03

CAF #62 Ensure the resolution of CR 03-01853 addresses the site wide issue of the effet that the elevated use of overtime may be having on plant personnel. Particular attention to the effect of fatigue and stress on personnel's fitness for duty.. (N/A)

NED J. Powers 5/30/03

CAF #63 Implement the plan for the transition of the EAB to station personnel and the evaluation of EAB membership that was developed in CAF #27. (I04)

NED J. Powers 06/30/03

CAF #64 Implement the performance indicators that were developed in CAFs #32, #37 and #42. (H02)

NED J. Powers 06/30/03

CAF #65 Ensure the implementation of the program that was developed in CAF #39 to evaluate each item in the backlog of design deficiencies including the schedule and dedicated resources for complete resolution. (H03)

NED J. Powers 12/30/03

References

Documents reviewed:

1) Safety Conscious Work Environment Survey Results
2) Davis-Besse Management and Human Performance Excellence Plan
3) Management and Human Performance Improvement Action Plan
4) Management and Human Performance Improvement Plan Status
5) Davis-Besse Engineering Organizational Development Plan
6) Davis-Besse Engineering Organization Charts
   - Current
   - Proposed
7) Davis-Besse System Health Reports, Fourth Quarter 2001
   - Executive Summary
   - Auxiliary Feedwater System
   - Component Cooling Water System
   - Decay Heat – Low Pressure Injection Systems
   - Reactor Coolant System
   - Containment Integrity
   - Heat Exchanger Performance Program
   - Leak Reduction Program
   - Primary Leakage Program
   - Preventive Maintenance Program
   - Temporary Modifications
8) Operability Evaluations
   - 2001-0001, Removal of One ECCS Room Cooler from Service
   - 2001-0002, MU Pump #2 pump inboard bearing sight glass is filling with oil.
   - 2001-0003, Refurbished breakers have different stock code arcing contact MTG kits.
   - 2001-0004, AFP #2 Agastat Relay PSL4931X2 trending slower.
   - 2001-0005, Indications of CRD power supply problems.
   - 2001-0006, SFAS Ch. 2 RCS Pressure power supply voltage degraded.
   - 2001-0007, MU Pump 1-1 outboard motor bearing RTD out.
   - 2001-0009, CF1544 leaks by closed seat.
   - 2001-0010, Loss of remote control of AFPT 2 governor.

- 2001-0011, EDG 2 fails to start on DA 31 side.
- 2001-0012, OJ for ECCS Room Cooler #5 maintenance.
- 2001-0013, EDG 1 fails to start on DA 30 side.
- 2001-0014, Door 321 failed 24 Hour Fire Door Visual Inspection Test.
- 2001-0015, High Voltage Switchgear Room temperature concerns.
- 2001-0017, OJ for ECCS Room Cooler #5 maintenance.
- 2001-0018, EDG kW output during testing.
- 2001-0019, Door 221 broken.
- 2001-0020, HIS 6454 on SFAS Ch. 2 went from low to high level select automatically.
- 2001-0021, Evaluation of letdown for an Appendix R Fire - Self-Assessment 2001-0108
- 2001-0022, EDG 2 DA 45 air start side relay valve DA 62 not resetting properly.
- 2001-0023, EDG 2 DA 31 delayed start.
- 2001-0024, Flooding in SW Pump Room during pump maintenance.
- 2001-0025, HFA Relays in SFAS Sequencer circuits.
- 2001-0026, Intake Structure flooding issue with pumps removed.
- 2001-0027, EDG 1 DA 44 air start side regulator valve, DA 2988, blowing air.
- 2001-0028, Errors in AFW DC-Powered MOV Voltage Drop Calculations.
- 2001-0029, Non-conformance of AFW Pump #2 for MSLB Break concurrent with LOOP
- 2001-0030, Non-conformance of AFW Pump #2 for MSLB Break concurrent with LOOP
- 2001-0031, AFW Pump operation following a seismic event and loss of Off Site Power.
- 2001-0032, Lack of positive indication of AFW valve control circuit isolation.
- 2001-0033, Over-torqued coupling bolts on EDG 1 in 1996.
- 2002-0001, OE-13070 (Greyboot Connectors) should be reviewed for impact on DB-ME-09500.
- 2002-0002, Potential generic snubber issue.
- 2002-0003, TS 3.9.2 LCO for Source Range NI'S during Refueling.
- 2002-0004, Decay Heat Pump #2 oil problems.
- 2002-0005, MS375 failed to stroke within its expected stroke time range.
- 2002-0006, Incorrect inert gas was used for West Electrical Penetrations.
- 2002-0007, DH14A did not meet its expected stroke time but was within the maximum stroke time.
- 2002-0008, VT-3 Examination failure for a snubber.
- 2002-0009, Environmental Qualification for flooding in the Auxiliary Building.

- 2002-0010, RC 1773A stroke time is outside its expected stroke time range.
- 2002-0011, Decay Heat Pump 1 inboard bearing oil discolored.
- 2002-0012, Unexpected AC Transformer lockout.
- 2002-0013, DH 14B stroke time outside of expected stroke time range.
- 2002-0014, RE 8447 spiking into alert.
- 2002-0015, EDG 1 power factor swings at low load.
- 2002-0016, Check valve CF30 banging in flow stream.
- 2002-0017, Leak on Decay Heat Train 1 Line.
- 2002-0018, CV5007 did not meet expected close stroke time range during DB-PF-03270.
- 2002-0019, Corrosion of Containment Vessel at interface with concrete. (R01 asked to include CR 02-2594 and 02-2595)
- 2002-0020, EWR 01-0402-00 EAB Review.
- 2002-0021, Painting in SFP without a paint permit.
- 2002-0022, Corrosion in Containment Penetrations.
- 2002-0023, Inadequate ventilation for Rooms 323, 324, 325.
- 2002-0024, Boric Acid is on the CCW pipes for DH Pump 1.
- 2002-0025, Lack of a Performance Test Acceptance Criterion Margin for SW flow to CCW Heat Exchangers.
- 2002-0026, Lack of a periodic testing verification for DBA ventilation flow rates.
- 2002-0028, Test Control Program Self-Assessment (Usable volume of fuel oil in the EDG Week Tanks).
- 2002-0029, EDG #2 Voltage Regulator and Governor stability.
- 2002-0030, EDG 1 and EDG 2 Room Inlet Air Damper Hydramotors possibly missing parts.
- 2002-0031, Potential "NON-Q" Material installed on Decay Heat Pump #2 rotating element.
- 2002-0032, Environmental Qualification items identified during the AFW Latent Issue Review.
- 2002-0033, EDG oil type in Intake Air Filter.
- 2002-0034, High silicon in EDG #1 Lube Oil.
- 2002-0038, Conflict between new baseline data and Design Basis for SW Pumps #1 and #3
- 2002-0039, Clearing Mode 6 restraint for EDG Operability based on ambient temperature

9) Engineering Self-Assessment Reports

- SA2001-0025, Ultimate Heat Sink

- SA2001-0052, Effectiveness Review of Root Cause for Year 2000 Equipment Issues
- SA2001-0061, Engineering Quality in Modification Packages
- SA2001-0063, System Engineer Roles and Responsibilities
- SA2001-0064, Ultimate Heat Sink (Lake Erie and Forebay)
- SA2001-0080, Effectiveness of Human Performance Program
- SA2001-0088, Inservice Test Program
- SA2001-0092, Vibration Program
- SA2001-0095, Design Criteria Manual
- SA2001-0096, Seismic Qualification
- SA2001-0097, EQ Program
- SA2001-0103, Shutdown PSA
- SA2001-0108, Safe Shutdown Analysis
- SA2001-0117, Maintenance Rule
- SA2002-0077, Boric Acid Corrosion Control Program

10) Davis-Besse Calendars

- Key Events Calendar
- Program Review Board Meetings
- Station Calendar

11) Davis-Besse Nuclear Quality Audit and Surveillance Reports

- AR-01-FIREP-01, Fire Protection Program
- AR-01-NFUEL-01, Special Nuclear Material Control Program
- AR-01-PROMC-01, Procurement, Material Control, and the Environmental Qualification (EQ) Program
- SR-01-ENGRG-01, 13RFO Modification Package Development and Implementation
- SR-01-ENGRG-02, Risk Assessment Process in the Conduct of Maintenance
- SR-01-ENGRG-04, Performance Monitoring, Inspection, and Maintenance of Heat Exchangers
- SR-01-ENGRG-05, New 10CFR50.59 Process Implementation
- SR-01-ENGRG-09, Emergency Diesel Generator Air Start Systems
- SR-01-ENGRG-010, Auxiliary Feedwater System
- SR-01-ENGRG-011, Maintenance Rule Program Compliance
- SR-01-ENGRG-012, Completed Modifications and the 10 CFR 50.59 Program
- SR-02-ENGRG-01, Effectiveness of Corrective Actions from AR-01-PROMC-01

12) Engineering Assessment Board Meeting Minutes

13) Program Review Board Meeting Minutes

Personnel interviewed:

1) Lew Myers, FENOC Chief Operating Officer
2) Gary Leidich, FENOC Executive Vice President
3) Randel Fast, Plant Manager
4) James Powers, Director of Nuclear Engineering
5) Robert Schrauder, Director of Support Services
6) Michael Stevens, Director of Work Management
7) Joe Rogers, Manager of Plant Engineering
8) John Grabnar, Manager of Design Basis Engineering
9) Andy Migas, Supervisor of Design Joint Engineering Team
10) Dave Gudger, Manager of Performance Improvement
11) Michael Roder, Manager of Nuclear Operations
12) Tony Stallard, Superintendent of Nuclear Operations
13) Richard Walleman, Nuclear Operations Shift Manager
14) On-Shift Operations Shift Supervisors (2)
15) Pete Roberts, Manager of Nuclear Maintenance
16) Greg Dunn, Manager of Work Control and Outage Management
17) Ron Wells, Superintendent of Nuclear Maintenance
18) John VanGelder, Superintendent of Nuclear Maintenance
19) Steve Seagall, Superintendent of Nuclear Maintenance
20) Rick Rospert, Supervisor of Nuclear Maintenance
21) Mark Gruenberg, Supervisor of Nuclear Maintenance
22) Jim Howell, Supervisor of Nuclear Maintenance
23) Pat McCloskey, Manager of Nuclear Regulatory Affairs
24) D.B. Kelley, Supervisor of Reactor Engineering
25) Dave Wahler, Reactor Engineer
26) Dave Dibert, Reactor Engineer
27) Dennis Mominee, Nuclear Engineering Supervisor
28) Guy Leblanc, Nuclear Engineering Supervisor
29) Jon Hook, Nuclear Engineering Supervisor
30) Ken Byrd, Nuclear Engineering Supervisor

31) Bob Hovland, Nuclear Engineering Supervisor
32) Allen McAllister, Nuclear Engineering Supervisor
33) John Cunnings, Nuclear Engineering Supervisor
34) Jim Marley, Nuclear Engineering Supervisor
35) Tim Ridlon, Design Engineer
36) Gabe Barteck, Design Engineer
37) Pete Jacobsen, Design Engineer
38) Dick Bair, Design Engineer
39) Bob Rishel, Design Engineer
40) Kevin Zellers, Design Engineer
41) Dennis Adams, System Engineer
42) Allen Wise, System Engineer
43) Tim Laurer, System Engineer
44) Eric Bennet, System Engineer
45) Tracy St. Clair, System Engineer
46) Dan Haley, System Engineer
47) Mat Murtha, System Engineer
48) Steve Osting, Program Manager
49) Kevin Bell, Program Manager
50) Jim Tabbert, Program Manager
51) Chuck Daft, Program Manager
52) Steve Henry, Engineering Planner and Scheduler
53) Steve Loehlein, Manager of Nuclear Quality Assessments
54) Ed Chimahusky, Supervisor of Engineering Assessments
55) Dave Studley, Former Chairman of Engineering Assessment Board
56) Henry Stevens, Chairman of Engineering Assessment Board
57) Bill Mugge, Manager of Nuclear Training
58) Bill Pearce, Vice President of FENOC Oversight

Methodologies employed:

Formal causal analyses have been performed for both the technical issues and the management and human performance issues associated with the degradation of the Davis-Besse Reactor Pressure Vessel Head. The cause analysis of the management and human performance issues resulting in the failure to prevent the degradation of the reactor pressure vessel head determined that the root cause was that management ineffectively implemented processes, and thus failed to detect and address plant problems as opportunities arose. Rather than repeat the previously

performed cause analysis, the investigation of the organizational effectiveness of the Davis-Besse Nuclear Engineering Organization focused on how to ensure the engineering organization could prevent this type of event from occurring again.

An assessment similar to the techniques used for the PII Stream Analysis and the PII Organizational Culture Assessment was performed to determine the symptoms of weaknesses in the organizational effectiveness of the Nuclear Engineering Department. Engineering programs, procedures, policies and products were reviewed. Engineering personnel as well as client personnel were interviewed. Meetings were observed where engineering personnel interacted with each other and with their peers from other organizations. The current and proposed new engineering organization charts with current and proposed staffing indicated were also reviewed. The assessment team experientially compared the results of these observations, reviews and interviews to the characteristics of top performing engineering organizations. Based on these comparisons, recommendations were developed for near term and for longer-term improvements.

A HPES Human Performance Causal Factors Analysis was performed using the evidence and conclusions of the assessment team to determine the root and contributing causes of the observed weaknesses and to validate the recommendations of the assessment team.

Attachments

1. Attachment A, Assessment of Engineering Report, dated 1/03/03
2. Attachment B, Implementation Plan for the Assessment of Engineering Capabilities Rev. 1
3. Attachment C, Human Performance Causal Factors Worksheets, Causal Factor Analysis

Assessment of Engineering

Date: 1/03/03

Assessment Team Members:

Mike Delowery file copy signed
Senior Evaluator, Engineering
Institute of Nuclear Power Operations

Rick Jacobs file copy signed
Director, Plant Support Division
Institute of Nuclear Power Operations

Mark Manoleras file copy signed
Manager, Design Engineering
Beaver Valley Power Station
First Energy Nuclear Operating Company

Rick Libra file copy signed
Director, Nuclear Engineering
Detroit Edison – Fermi 2

Jim Meister file copy signed
Vice President, Engineering
Exelon Nuclear

Jim Maddox file copy signed
Vice President, Nuclear Engineering
and Technical Services
Tennessee Valley Authority

Danny Pace file copy signed
Vice President Engineering
Entergy Nuclear Northeast

Charlie Cronan file copy signed
Vice President & Director of
Engineering, Stone & Webster Power
Division, Shaw Group

Concurrence:

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Manager, Plant Engineering
Davis-Besse Nuclear Power Station
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Company

John Grabnar file copy signed
Manager, Design Engineering
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Director, Nuclear Engineering
Davis-Besse Nuclear Power Station
Company

Gary Leidich file copy signed
Executive Vice President
First Energy Nuclear Operating

DAVIS-BESSE NUCLEAR POWER STATION

INDUSTRY ASSESSMENT OF ENGINEERING

I. Purpose and Summary

From December 9-13, 2002, an independent industry team performed an assessment of the Davis-Besse Nuclear Power Station (DBNPS) engineering organization. The assessment was facilitated by the Institute of Nuclear Power Operations (INPO) and included senior industry leaders. The team's objective was to evaluate the organizational effectiveness of the DBNPS engineering organization and the capability of the organization to support safe plant operations and to identify any areas for improvement, particularly focused over the long-term. The team did not make judgments regarding the technical adequacy of engineering work.

The team identified a need to focus on building and maintaining a solid engineering organization over the long term. Specifically, the team identified and made recommendations for improvement in the following areas:

- Engineering Organization
- Engineering Roles and Responsibilities
- Staff Development
- Learning Organization
- Resolution of Open Items
- Engineering Assessment Board
- Owner Acceptance of Vendor Products
- Work Management
- Performance Monitoring

FENOC subsequently developed a plan for implementing the team's recommendations, along with integrating them into the FENOC Corporate planning. The Implementation Plan for the Assessment of Engineering Capabilities is included as an attachment to this report.

II. Background

In February 2002, significant degradation of the reactor vessel head was discovered at the station. Weaknesses in engineering effectiveness contributed to the head degradation event. As part of the corrective actions for the event, First Energy Nuclear Operating Company (FENOC) management committed to performing an assessment of current engineering capability.

In response to this commitment, Gary Leidich, executive vice president at FENOC, requested that INPO facilitate an Industry Assessment of Engineering.

The assessment team was comprised of the following members:

Rick Jacobs, Director of Plant Support Division, INPO
Jim Maddox, Vice President of Engineering & Technical Services, TVA
Jim Meister, Vice President of Engineering, Exelon Nuclear
Danny Pace, Vice President of Engineering, Entergy Nuclear Northeast
Rick Libra, Director of Nuclear Engineering, Fermi 2
Charles Cronan, Vice President of Engineering, Shaw Group
Mike Delowery, Senior Evaluator, INPO

III. On-Site Activities

An entrance meeting was held with site management on December 9, 2002 to discuss the scope and logistics for the visit. Information was obtained during the visit through interviews with a cross-section of station personnel and reviews of appropriate station documentation. The team worked closely with station engineering leadership to develop the recommendations. The results of the assessment were discussed with Gary Leidich, Executive Vice-President; Lew Meyers, Chief Operating Officer and acting Site Vice-President; Jim Powers, Director of Engineering; Bill Pierce, Vice-President of Oversight; and key engineering managers on December 13, 2002.

IV. Assessment

Davis-Besse has been shut down for approximately 10 months at the time of this assessment. Substantial progress has been achieved in the building block programs by providing focused project management as well as contract resources. This short-term focus on extent of condition from the causes and contributors to the reactor vessel head degradation event has held management's attention (appropriately). Renewed focus on building and maintaining a solid engineering organization over the long-term is now needed.

The following discussion provides further elaboration on the areas reviewed. The specific improvement areas with recommended actions are provided in Section V of this report.

A. Engineering Organization

Although the engineering leadership team is not in place, positive steps were taken to establish the leadership team with the recent movement of experienced company personnel into the director–nuclear engineering, manager-design basis engineering, and manager-projects positions. However, significant weaknesses exist with first-line supervisor ranks. Two of four plant engineering supervisor positions are vacant, with one of the remaining supervisors temporarily assigned to restart activities. Two of four supervisor positions in design engineering are vacant. Also, the manager-plant engineering is moving to a new position. The mechanical system design organization has significant vacancies.

The first and arguably most important step to full organization recovery is to select and fill these positions. The absence of leaders in these positions fosters organization misalignment, low morale, misinformation and the reduced ability to coordinate work within the station. In many groups, engineers do not receive necessary coaching, technical guidance, or reinforcement of expected behaviors.

B. Engineering Roles & Responsibilities

Substantial information was evident to suggest that clear roles and responsibilities for engineering either do not exist or are misunderstood. For example, many people interviewed questioned the engineering involvement in day-to-day maintenance activities. There is a strong need to implement the following: 1) clearly define the roles and therefore the accountability of each engineering department/section; and 2) work with senior management, other station organizations, and the engineering organization to gain acceptance and support for these roles. Also, the Davis-Besse organization is different from the other FENOC engineering organizations. The station should adopt the FENOC standard organization for engineering as soon as possible. It is the team's judgment that rebuilding the engineering capability at Davis-Besse takes precedence over staffing engineering functions in the proposed corporate organization.

Teamwork and alignment of purpose, both internal to engineering and among departments, will be key to long-term success. Recommendations are included for engineering management and supervisory personnel to retreat from the site to develop the items spelled out above and come together as a management team. They should work together to articulate what a healthy, well-functioning engineering organization looks and feels like. They should develop a renewed sense of commitment to lead engineering to achieve its future vision and support each other as they work to achieve that goal.

It will be important for the proper level of engineering management to be represented, together with counterparts in other organizations, at all key leadership activities. Site leadership needs to be consistently supportive and offer positive, constructive feedback as engineering seeks to improve.

C. Staff Development

With the engineering team in place, emphasis needs to be on performance management of the engineering personnel. A good first step has been taken with development of engineering principles and expectations. The entire staff needs to become ingrained with and live up to these principles and expectations. Engineering management, in meetings and other interactions with the engineering staff, should set the example and live up to these expectations and principles. Engineering management should provide consistent coaching to the staff to reinforce the expected behaviors.

D. Learning Organization

Emphasis also needs to be placed on making engineering a learning organization. The lessons learned from the ongoing engineering review and assessment activities are not being captured and cataloged for use by FENOC personnel. Several good practices have been implemented, such as the Engineering Assessment Board (EAB) and the systematic reviews of programs and plant systems; however, feedback to the engineering training program is not provided to ensure all appropriate engineering personnel learn from these activities. Minimal participation in external industry activities can lead to an isolated organization. Therefore, a plan is needed to force appropriate involvement.

E. Resolution of Open Items

The discovery phase in each area under engineering cognizance (containment health, system health and latent issue reviews, and program reviews) is coming to completion. Containment health has evaluated the impact of the reactor coolant system leak on systems and components within the containment building. System readiness reviews have determined the current statuses of the systems, as well as refreshed the system engineers on the systems. Open issues have been cataloged through latent issue reviews for selected systems and by other system design reviews.

Many of the deficiencies identified from these reviews were known and documented prior to the event at Davis-Besse but were not corrected. Regardless of the reasons for failure to follow through on these open items in the past, 1) a program should now be defined that properly evaluates each item based on plant impact and potential risk; 2) schedules for completion of the outstanding items should be developed based on risk significance; and 3) resources should be dedicated over the next few years to fully complete this effort. Station management must understand the importance of closing out open design items

and implementing configuration management programs properly to prevent repeating these problems.

V. Recommendations for Improvement

The following recommendations are provided for consideration and incorporation into an Engineering Excellence Plan.

A. Engineering Organization

Focus: Key management and supervisory positions remain open in the organization. The absence of individuals in these leadership positions fosters organizational misalignment, low morale, misinformation, and the inability to coordinate work within the station.

Recommendations:

1. Recruit and fill key manager and supervisory positions in the engineering organization. Although vacancies exist across the organization, the need to fill these positions is most acute in plant engineering.
2. Standardize the Davis-Besse engineering organization and functions consistent with the other FENOC sites.
3. Principles and expectations exist for the engineering organization. As a new engineering management team is developed, the opportunity exists to develop expectations for management involvement and behaviors. When manager and supervisor vacancies are filled, have engineering management meet off-site to build as a team and agree on behaviors and principles for the management team such as feedback and coaching, involvement in daily activities, reinforcement of principles and expectations, setting good examples, and communications.

B. Engineering Roles and Responsibilities

Focus: The engineering organization roles and responsibilities at the station are not clearly defined. This condition has impacted the ability of engineering and the station to efficiently process work, establish appropriate accountabilities, and prioritize core engineering functions.

Recommendations:

1. Develop proposed vision, roles, and responsibilities for engineering. Analyze how well engineering is meeting these roles today and identify gaps.
2. Work with counterparts at senior management, director, manager, and supervisor levels to obtain agreement that proposed roles and responsibilities are the right ones and that the entire site organization will support them. Focus should be on how to reduce engineering involvement with routine maintenance, operational, and other day-to-day work while ensuring true engineering needs continue to be met and preserving and enhancing relationships.
3. Develop and implement a communication and training plan on revised engineering roles and responsibilities.

4. Identify process, procedure, and program constraints that are at odds with desired roles and responsibilities for engineering. Modify these processes as appropriate to be consistent with desired roles.

C. Staff Development

Focus: Key positions in plant and design engineering are currently vacant, staffed with temporary personnel, or staffed with personnel not fully qualified. The lack of succession planning in engineering has resulted in posted supervisor positions with no or limited applicants.

Recommendations:

1. Develop a staffing and qualification plan to fill existing organizational gaps to the standard site organizational structure. Include existing operations and maintenance personnel in the potential pool of candidates. Special consideration should be given to ensure sufficient plant-specific, PWR, and operational experience exists in the engineering organization.
2. Reinforce individual accountability and performance through use of the FENOC ownership for excellence process.
3. Develop a succession plan down to the supervisor level in engineering. Target individual contributors in the organization to receive leadership and supervisory training prior to assuming
4. Reinstitute operational training for technical personnel, such as a SRO Certification Program.

D. Learning Organization

Focus: Engineering is not sufficiently capitalizing on learning from the current station shutdown to improve processes and develop personnel. Examples are that leads for most major initiatives are with contract personnel, and feedback from Engineering Assessment Boards is not shared with the organization. Also, training opportunities are not routinely being identified to improve performance.

Recommendation:

1. Establish FENOC leads for appropriate contracted work to maximize transfer of knowledge.
2. Reinforce expectations associated with the engineering training program. For example, training topics to improve engineering performance should be collected from EAB feedback, condition reports, and observations.
3. Develop a plan to increase engineering personnel involvement and knowledge of industry activities. Include within the plan benchmarking of other sites, participation with industry engineering-related working groups, and assessment activities with other sites. Set the expectation that best practices are incorporated into station conduct of engineering activities.

E. Resolution of Open Items

Focus: It is clear the engineering team recognizes the importance of configuration management. However, a backlog of design deficiencies exists from building-block reviews and from previous reviews and programs. Priority has not been given to complete these backlog items in the past.

Recommendations:

1. Develop a program that properly evaluates each item based on plant impact and potential risk. (Expert panel reviews should be considered.)
2. Design a schedule for completion of the outstanding items based on risk significance. The schedule should reflect the engineering organization's ability to complete the work with Davis-Besse personnel involved in the resolution.
3. Identify potential critical items, such as auxiliary feedwater equipment qualification and service water design margins, and provide management focus on a proper resolution of these items.
4. Dedicate resources for the ultimate completion of items from the system and program reviews. This is a long-term project, and the FENOC organization must commit to it to ensure this issue is completely resolved.

F. Engineering Assessment Board

Focus: EAB process improvements are needed to maximize board effectiveness. The EAB must transition from a process barrier to an assessment board, with the objective of raising quality standards in engineering products.

Recommendations:

1. Capture and trend results of the EAB reviews, and ensure line management uses the information to develop corrective actions to address deficiencies more proactively.
2. Develop a plan for transition of the EAB to the station personnel, including roles and responsibilities and a method to confirm the appropriateness of the membership.

G. Owner Acceptance of Vendor Products

Focus: The expectations for review and acceptance of vendor products are unclear, contributing to inconsistent reviews and high backlogs of products requiring review by Davis-Besse personnel. Typical review resources in the industry can be up to 10-15% of the total project resource requirements. Opportunities exist to conduct these reviews more efficiently and effectively by better defining the scope of work and conducting in-process reviews.

Recommendations:

1. Review of portions of vendor products early to ensure that the requested scope is being met to prevent rework. Portions of the owner's review can be done in parallel and meetings held in-process to resolve discrepancies. An owner's review should be completed prior to acceptance of the product.

2. Develop expectations and structure for vendor review. Include in-process reviews and clear scoping.

3. Establish and review scope definition and performance indicators to ensure efficient and quality contractor work.

H. Work Management

Focus: Engineering lacks effective work management to enable appropriate prioritization and management of engineering resources. This condition has resulted in work inefficiencies, frequent priority changes, and, in some cases, a disconnect between the station and engineering priorities.

Recommendations:

1. Implement an engineering work request system to capture all critical engineering work, and use a simple priority system to decide actions.

2. Implement a system to schedule all engineering work. Ensure the engineering schedule is integrated with the site schedule.

3. Develop indicators that measure and set goals for backlog, throughput, and age.

4. For all engineering programs, establish a method that identifies what work is required to be done and when, and flag management when items are not completed.

I. Performance Monitoring

Focus: Management lacks effective tools for monitoring and trending the engineering organization performance.

Recommendations:

1. Develop and implement performance indicators with goals that measure quality of engineering work, system and program health, and work management.

2. Develop and implement a robust self-assessment program that critically assesses all key elements of engineering performance, programs, and processes on a periodic basis.

Implementation Plan for the Assessment of Engineering Capabilities Rev. 1

Issue Summary	Recommended Actions	Accountability	Due Date
A. Management:			
Key positions remain open in the organization. This fosters organizational misalignment, low moral, misinformation, and the inability to coordinate work.	1. Fill managerial and supervisory position vacancies.	J. Powers	01/24/03
	2. Hold Teambuilding session for Davis-Besse Engineering Supervisory personnel.	J. Powers	01/31/03
	3. Coordinate an initial meeting of Engineering Supervisors for the communication of behaviors/expectations for FENOC Engineering.	K. Pech	02/15/03
	4. Standardize the Davis-Besse Engineering organization and functions consistent with the FENOC model.	J. Powers	02/07/03

Approved By: Original Signed
James J. Powers
Director, Nuclear Engineering
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Gary R. Leidich
Executive Vice President
First Energy Nuclear Operating Company

Approved By: Original Signed
Lew W. Myers
Chief Operating Officer
First Energy Nuclear Operating Company

Implementation Plan for the Assessment of Engineering Capabilities Rev. 1

Issue Summary	Recommended Actions	Accountability	Due Date
B. Engineering Roles and Responsibilities:			
The organization's roles and responsibilities are not clearly defined. This impact the ability to process work, establish accountabilities and prioritize core functions.	1. Develop proposed vision, roles and responsibilities for the engineering organization.	G. Leidich	02/13/03
	2. Obtain agreement with and support from station counterparts that the proposed roles and responsibilities are right.	J. Powers	01/31/03
	3. Develop communication plan on the revised engineering roles and responsibilities.	R. Wilkins	01/24/03
	4. Approve communication plan.	G. Leidich	01/27/03
	5. Communicate new organizational roles and responsibilities.	G. Leidich	02/15/03
	6. Fill open position for Engineering Training Instructor.	M. Marler	01/24/03
	7. Develop and implement training plan on revised engineering roles and responsibilities.	M. Marler	02/28/03
	8. Identify and modify process, procedure and program constraints that conflict with the desired engineering roles and responsibilities.	D. Woodfin	02/28/03

Implementation Plan for the Assessment of Engineering Capabilities Rev. 1

Issue Summary	Recommended Actions	Accountability	Due Date
C. Staff Development:			
The lack of succession planning has resulted in posted supervisor positions with no or limited applicants.	1. Reinforce individual accountability and performance through utilization of FENOC Ownership for Excellence process.	J. Powers	02/28/03
	2. Develop staffing and qualification plan for the organizational gaps, including operations and maintenance personnel in the potential pool of candidates with special consideration for plant specific, PWR and operational experience.	F. Giese	03/31/03
	3. Develop succession plan down to the supervision level targeting individual contributors to receive leadership and supervisory training prior to assuming positions. Include targeted rotations inside and outside of engineering in the plan.	J. Powers	03/31/03
	4. Coordinate the development of succession plans at Davis-Besse with FENOC wide succession planning activity.	F. Giese	04/30/03
	5. Present options for improving the operational focus of technical personnel to the training council such as utilizing the Senior Reactor Operator Certification and License Program.	M. Marler	06/30/03

Implementation Plan for the Assessment of Engineering Capabilities Rev. 1

Issue Summary	Recommended Actions	Accountability	Due Date
D. Learning Organization:			
Engineering is not capitalizing on opportunities to learning from the station shutdown to improve processes and develop personnel.	1. Assign FENOC leads to all contracted work to maximize transfer of knowledge.	C. Hawley	01/31/03
	2. Strengthen the Engineering Training Program to incorporate current lessons learned (e.g., EAB feedback, CR feedback, observations, etc.)	M. Marler	01/31/03
	3. Develop a plan and process to increase engineering personnel involvement and knowledge of industry activities including: d. Benchmarking of other utilities, e. Participation in industry working groups, and f. Assessments at other utilities Set expectation that best practices are incorporated into conduct of engineering.	K. Pech	02/14/03

Implementation Plan for the Assessment of Engineering Capabilities Rev. 1

Issue Summary	Recommended Actions	Accountability	Due Date
F. Owner Acceptance of Vendor Products			
The expectations for review and acceptance of vendor products are unclear, leading to inconsistent reviews and high backlogs needing acceptance.	1. Establish a standard directive (NOP) on owner's acceptance of contracted/vendor work.	W. Kline	01/31/03
	2. Define interim deliverables for project management and mid-course direction for owner's acceptance.	W. Kline	01/31/03
	3. Incorporate improvements into NOP-CC-2003, Engineering Changes.	W. Kline	01/31/03
	4. Establish performance indicators for measuring vendor performance.	T. Lentz	01/31/03

Implementation Plan for the Assessment of Engineering Capabilities Rev. 1

Issue Summary	Recommended Actions	Accountability	Due Date
G. Work Management:			
Engineering lacks an effective work management tool to enable appropriate prioritization and management of resources resulting in work inefficiencies, frequent priority changes and some disconnects between station and engineering priorities.	1. Develop the engineering work request and scheduling system that captures all critical engineering work and uses a simple priority system to decide actions.	K. Pech	06/30/03
	2. Establish method for tracking and notification of activities directed by all engineering programs similar to surveillance activities.	K. Pech	06/30/03
	3. Implement corporate standard for accessibility of engineering documents (i.e. ATLAS software).	K. Pech	06/30/03
	4. Implement the scheduling system for all engineering work that is integrated with the Davis-Besse site schedule.	C. Hawley	07/30/03
	5. Develop performance indicators that set goals and measure backlog, throughput and age.	T. Lentz	08/30/03

Implementation Plan for the Assessment of Engineering Capabilities Rev. 1

Issue Summary	Recommended Actions	Accountability	Due Date
H. Resolution of Open Items:			
A backlog of design deficiencies exists from building block reviews and previous reviews and assessments. Priority has not been given to complete these backlog items in the past.	1. Ensure the resolution of deficiencies required for Davis-Besse restart is complete.	R. Schrauder	03/30/03
	2. Develop a program to properly evaluate each item based on plant impact and potential risk such as using expert panel reviews.	C. Hawley	06/30/03
	3. Develop a schedule for completion of the open items based on risk significance and the engineering organization's ability to be involved in the resolutions.	C. Hawley	06/30/03
	4. Dedicate resources for the ultimate completion of the project on a long-term basis ensuring the issue is completely resolved.	D. Eshelman	06/30/03

Implementation Plan for the Assessment of Engineering Capabilities Rev. 1

Issue Summary	Recommended Actions	Accountability	Due Date
I. Performance Monitoring:			
Management lacks effective tools for monitoring and trending of the engineering organization's performance.	1. Develop and implement performance indicators with set goals for: • Quality of engineering work, • System and Program health, and • Work Management.	T. Lentz	01/31/03
	2. Ensure indicators are consistent throughout FENOC.	D. Eshelman	02/28/03
	3. Develop a FENOC self-assessment program, including Senior Management's approval, that critically assesses all key elements of engineering performance, programs and processes on a periodic basis.	K. Pech	03/31/03
	4. Implement the self-assessment program at Davis-Besse.	J. Powers	06/30/03

Attachment C
Human Performance Causal Factors Worksheets
CAUSAL FACTOR ANALYSIS

A. Verbal Communication - The spoken presentation or exchange of information

☐ Applicable ☒ Not Applicable

1.

Communication Type	I	II	III	IV
a. Face-to-face				
b. Telephone				
c. Intercom or page				
d. Hand signal				
e. Radio/headset				
z. Other (specify)				

2.

Intended Function	I	II	III	IV
a. Shift/job turnover				
b. Pre-job briefing				
c. Job performance				
d. Post-job follow-up				
z. Other (specify)				

Why was communication a cause?

3.

Rate (1, 2, 3) each cause:

1 = Primary
2 = Secondary
3 = Possible

	I	II	III	IV
a. Pre-job briefing not performed/completed				
b. Consequences of potential error not discussed before starting work				
c. Notification not made/required when job began, was interrupted, or was completed				
d. Shift turnover not performed/completed				
e. Supervisor not notified of suspected problem				
f. Pertinent information not transmitted				
g. Information sent but not understood				
h. Inaccurate message transmitted				
i. Too much unfamiliar information presented at once				
j. Information communicated too late				
k. No means of communication available				
l. Inadequate/malfunctioning communication equipment				
m. Deleted				
n. Deleted				
o. Interpretable/non-standard language used				
p. Receiver not listening to sender				
q. Deleted				
r. Priorities of assigned tasks not discussed				
s. Three part communications not used/ not effective				

Attachment C
(continued)
CAUSAL FACTOR ANALYSIS

B. Written Communication - The written presentation or exchange of information

☐ Applicable ☒ Not Applicable

1.

Instruction Type	I	II	III	IV
a. Permanent procedure				
b. Temporary procedure				
c. Informal				
d. Maintenance work order				
e. Vendor manual instruction				
f. Night orders/memos				
g. Drawings				
h. Technical specifications				
i. Clearance tagging/logs				
j. Design documents				
z. Other (specify)				

2.

Instruction Function	I	II	III	IV
a. Plant operation				
b. Abnormal operation				
c. Emergency operation				
d. Maintenance				
e. Surveillance check/functional test				
f. Calibration				
g. Radiation/contamination control				
h. Chemical control				
i. Modification implementation				
z. Other (specify)				

Why were the written instructions a cause?

Rate (1, 2, 3) each cause:

1 = Primary
2 = Secondary
3 = Possible

3.

Method of Presentation	I	II	III	IV
a. Instruction step/information in wrong sequence				
b. Format deficiencies				
c. Deleted				
d. Deleted				
e. Improper referencing or branching				
f. Unclear/complex wording or grammar				
g. Illegibility				
h. Inappropriate emphasis of step/information				
i. Deficiencies in user aids (charts, etc.)				
j. Deleted				
k. Procedure changes not made apparent to user				
z. Other (specify)				

4.

Content	I	II	III	IV
a. Insufficient information to identify the correct document				
b. Technical inaccuracies				
c. Omission of relevant information				
d. Inadequate documentational provisions				
e. Not properly coordinated with change implementation				
f. Deleted				
g. Information is too generic (not equipment-specific)				
h. Deleted				
i. Program/ process weakness				
z. Other (specify)				

5.

No Procedure	I	II	III	IV
a. Procedure needed but not has not been written				
z. Other (specify)				

Attachment C
(continued)
CAUSAL FACTOR ANALYSIS

B. Interface Design or Equipment Condition - The interface compatibility between humans and the equipment to be operated including the physical condition of the equipment

☐ Applicable ☒ Not Applicable

1.

Type of Display/Signal	I	II	III	IV
a. Labels				
b. Demarcation/mimic lines				
c. Annunciators				
d. Status lights				
e. CRT/Video				
f. Printers				
g. Recorders				
h. Meters				
i. Audible				
z. Other (specify)				

2.

Type of Control	I	II	III	IV
a. Knobs				
b. Handwheels				
c. Levers/Slide switches				
d. Pushbuttons				
e. Switches				
f. Manual/auto selectors				
g. Setpoint selectors/controllers				
h. Computer entry devices				
z. Other (specify)				

Why was equipment design/condition a cause?

Rate (1, 2, 3) each cause:

1 = Primary
2 = Secondary
3 = Possible

3.

Interface Design	I	II	III	IV
a. Control/display needed but absent				
b. Identification of control/display inadequate				
c. Inadequate layout design				
d. Deleted				
e. Manipulatability inadequate				
f. Accessibility inadequate				
g. Accuracy of display not adequate				
h. Precision of control not adequate				
i. Operating range inappropriate				
j. Design convention not followed				
k. Deleted				
l. Not properly coordinated with change implementation				
m. Uniqueness of design not made apparent or emphasized				
n. Equipment reliability not adequately addressed in design				
o. Non-task information distracted from use of task information				
p. Deleted				
z. Other (specify)				

4.

Equipment Condition	I	II	III	IV
a. Labels not maintained/restored				
b. Deleted				
c. Controls not maintained/functional				
d. Uncorrected equipment problems				
e. Unusual plant conditions/configuration				
z. Other (specify)				

Attachment C
(continued)
CAUSAL FACTOR ANALYSIS

D. Environmental Conditions - Physical conditions of work area.
☐ Applicable ☒ Not Applicable

Why was the environment a cause?

Rate (1, 2, 3) each cause:

1 = Primary
2 = Secondary
3 = Possible

1.	I	II	III	IV
a. Too much/too little lighting				
b. Deleted				
c. Poor work place layout				
d. Cramped conditions				
e. Untidy work area (water on floor, etc.)				
f. Too many people in area				
g. Excessive noise level				
h. Uncomfortable temperature and/or humidity				
i. High radiation in the area				
j. High radiation associated with task				
k. Deleted				
l. Deleted				
m. Uncomfortable amount/length of use of protective clothing				
n. Exposed hot piping, unsecured equipment, exposed shock hazard				
z. Other (specify)				

Attachment C
(continued)
CAUSAL FACTOR ANALYSIS

E. Work Schedule - Factors that adversely affect the ability of personnel to effectively perform assigned tasks.

☐ Applicable ☒ Not Applicable

1.

Type of Problem	I	II	III	IV
a. Excessive overtime				
b. Call-in				
c. Overall schedule design				

Why was the work schedule a cause?

Rate (1, 2, 3) each cause:

1 = Primary
2 = Secondary
3 = Possible

2.

	I	II	III	IV
a. Unable to adjust sleep to rotating schedule				
b. Normal sleep time disrupted by schedule				
c. Reduced alertness/fatigue				
z. Other (specify)				

Attachment C
(continued)
CAUSAL FACTOR ANALYSIS

F. Work Practices - Worker methods and ingrained habits used in the completion of a task.

☐ Applicable ☒ Not Applicable

1.

Document That States the Work Practice	I	II	III	IV
a. Administrative procedure				
b. Job procedure				
c. Other job documents				
d. Not formally stated				

2.

Intended or Required Error Detection Method	I	II	III	IV
a. Self-checking				
b. Immediate check by second person				
c. Delayed check by second person				
d. Documented				
e. Direct				
f. Indirect				

Why were work practices a cause?

Rate (1, 2, 3) each cause:

1 = Primary
2 = Secondary
3 = Possible

3.

Error Detection Practices	I	II	III	IV
a. Self-checking not applied to ensure correct unit or train				
b. System alignment, tagout, restoration not verified				
c. General equipment condition (temperature, pressure, etc.) not checked before starting work				
d. Self-checking not applied to ensure correct component				
e. Self-checking not applied to ensure intended action is correct				
f. Self-checking not applied to ensure expected response				
g. Other intended or required verification not performed (specify)				
z. Other (specify)				

4.

Document Use Practices	I	II	III	IV
a. Required procedures, drawings, etc., not used				
b. Documents not followed correctly				
c. Up-to-date documents not used				
z. Other (specify)				

5.

Equipment/Material Use Practices	I	II	III	IV
a. Used tool(s) not designed for job				
b. Made unauthorized material substitution				
c. Improper/nonuse of protective environmental clothing				
d. Improper/nonuse of equipment				
z. Other (specify)				

6.

Worker's Preparation Practices	I	II	III	IV
a. Not having needed materials, tools, or equipment at job site before starting job				
b. Not having proper information/instructions at job site before starting job				
z. Other (specify)				

Attachment C
(continued)
CAUSAL FACTOR ANALYSIS

G. Work Organization/Planning - Work related tasks involving the scoping, planning, assignment and scheduling of a task to be performed.

☐ Applicable ☒ Not Applicable

Why were work organization methods a cause?

Rate (1, 2, 3) each cause:

1 = Primary
2 = Secondary
3 = Possible

1.

	I	II	III	IV
a. Insufficient time for worker to prepare for task				
b. Insufficient time allotted for task				
c. Duties not well-distributed among personnel				
d. Too few workers assigned to task				
e. Insufficient number of trained or experienced workers assigned to task				
f. Planning not coordinated with inputs from walkdowns/task analysis				
g. Job scoping did not identify potential task interruptions/environmental stress				
h. Job scoping did not identify special circumstances/conditions				
i. Work planning not coordinated with all departments involved in task				
j. Problem performing repetitive tasks/subtasks				
k. Inadequate work package preparation				
l. Schedule logic errors				
z. Other (specify)				

Attachment C
(continued)
CAUSAL FACTOR ANALYSIS

H. Supervisory Methods - Techniques used to monitor, direct and control work assignments.

☒ Applicable ☐ Not Applicable

Why were supervisory methods a cause?

Rate (1, 2, 3) each cause:

1 = Primary

2 = Secondary

1.	I	II	III	IV
a. Tasks and individual accountability not made clear to worker	2			
b. Progress/status of task not adequately tracked	2			
c. Appropriate level of in-task supervision not determined prior to task				
d. Direct supervisory involvement in task interfered with overview role				
e. Emphasis on schedule exceeded emphasis on methods/doing a good job				
f. Job performance and self-checking standards not properly communicated	2			
g. Too many concurrent tasks assigned to worker				
h. Frequent job or task "shuffling"	2			
i. Assignment did not consider worker's need to use higher-order skills				
j. Deleted				
k. Deleted				
l. Contact with personnel too infrequent to detect worker habit/attitude changes				
m. Deleted				
z. Other (specify)				

Attachment C
(continued)
CAUSAL FACTOR ANALYSIS

I. Training/Qualification - The process of presenting training information on how a task is to be performed prior to accomplishing the task.

☒ Applicable ☐ Not Applicable

1.

Was Training Content Established by Task Analysis?	**I**	**II**	**III**	**IV**
a. Yes				
b. No				

2.

How Long Since Person Involved Successfully Performed or Showed Competence in Task?	**I**	**II**	**III**	**IV**
a. Less than 1 week				
b. 1 week to 1 month				
c. Between 1 and 6 months				
d. Between 6 months and 1 year				
e. More than 1 year				
f. Never performed task				

3.

How Was Person Involved Trained for Task?	**I**	**II**	**III**	**IV**
a. Classroom lecture				
b. Laboratory training				
c. Guided self-study/computer-assisted				
d. Informal on-the-job training				
e. Structured on-the-job training				
f. Part-task simulator				
g. Control room simulator				
h. Equipment mock-up				
i. Skill learned on previous job at another facility				
j. No training provided				
z. Other (specify)				

Why were training methods a cause?

Rate (1, 2, 3) each cause:

1 = Primary
2 = Secondary
3 = Possible

Content Did Not Adequately Address	**I**	**II**	**III**	**IV**
a. Generic systems/components				
b. Specific systems/components				
c. Deleted				
d. Deleted				
e. Procedures/references used to perform task				
f. Relation of task to overall plant operations				
g. Potential consequences of inappropriate actions	2			
h. Verification/self-checking practices	2			
i. Deleted				
j. Job performance standards	2			
k. Deleted				
l. Demonstrating task proficiency				
z. Other (specify)				

Training Method	**I**	**II**	**III**	**IV**
a. Deleted				
b. Insufficient practice or hands-on experience				
c. Inadequate assessment of task proficiency				
d. Insufficient refresher training				
e. Absence of training objectives				
f. Deleted				
g. No training provided				
h. Not properly coordinated with change implementation	2			
i. Deleted				
z. Other (specify)				

Attachment C
(continued)
CAUSAL FACTOR ANALYSIS

J. Change Management - The process by which changes are controlled and implemented.
☒ Applicable ☐ Not Applicable

Why was change management a cause?

1 Rate (1, 2, 3) each cause:

1 = Primary
2 = Secondary
3 = Possible

	I	II	III	IV
a. Problem identification methods did not identify need for change	2			
b. Change not implemented in a timely manner	2			
c. Deleted				
d. Inadequate vendor support of change				
e. Risks and consequences associated with change not adequately reviewed or assessed	2			
f. System interactions not considered				
g. Personnel/department interactions not considered				
h. Effect of change on schedules not adequately addressed				
i. Change-related training/retraining not performed or not adequate				
j. Change-related documents not developed or not revised	2			
k. Change-related equipment not provided or not revised				
l. Change not adequately communicated				
m. Change not identifiable during task				
n. Accuracy/effectiveness of change not verified or not validated	2			
o. Deleted				
z. Other (specify)				

Attachment C
(continued)
CAUSAL FACTOR ANALYSIS

K. Resource Management - The process whereby manpower and material are allocated.

☒ Applicable ☐ Not Applicable

Why was resource management a cause?

1Rate (1, 2, 3) each cause:

1 = Primary
2 = Secondary
3 = Possible

	I	II	III	IV
a. Too many administrative duties assigned to immediate supervisors				
b. Insufficient supervisory resources to provide needed supervision	2			
c. Insufficient manpower to support identified goal/objective				
d. Resources not provided to ensure adequate training is provided/maintained				
e. Deleted				
f. Deleted				
g. Means not provided for ensuring adequate availability of appropriate materials/tools	2			
h. Means not provided for ensuring adequate equipment quality/reliability/operability	2			
i. Deleted				
j. Deleted				
z. Other (specify)				

Attachment C
(continued)
CAUSAL FACTOR ANALYSIS

L. Managerial Methods – The processes used to control or direct work-related plant activities, including how manpower and material is allocated for a particular objective.

☒ Applicable ☐ Not Applicable

Why were managerial methods a cause?

1 Rate (1, 2, 3) each cause:

1 = Primary
2 = Secondary
3 = Possible

	Management Directions	I	II	III	IV
1.	a. Policy guidance/management expectations were not well defined or understood	1			
	b. Job performance standards were not adequately defined.	1			
	c. Personnel exhibited insufficient awareness of the impact of actions on nuclear safety or reliability.	1			
2.	**Management Monitoring**	**I**	**II**	**III**	**IV**
	a. Management follow-up or monitoring of activities did not identify problems.	1			
3.	**Management Assessment**	**I**	**II**	**III**	**IV**
	a. Causes of a previous event or known problem were not determined.	1			
	b. Previous industry or in-house operating experience was not effectively used to prevent problems.	1			
4.	**Accountability**	**I**	**II**	**III**	**IV**
	a. Responsibility of personnel was not well defined or personnel were not held accountable.	1			
5.	**Corrective Action**	**I**	**II**	**III**	**IV**
	a. Response to a known or repetitive problem was untimely.	1			
	b. Corrective action for previously identified problem or previous event cause was not adequate to prevent recurrence	1			
	c. Inadequate implementation of corrective actions	1			
6.	**Other (specify)**	**I**	**II**	**III**	**IV**