Davis-Besse Nuclear Power Station

Management and Human Performance Root Causes

August 15, 2002

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Management and Human Performance Root Causes

Introduction

Lew Myers

FENOC Chief Operating Officer

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Agenda

- **Introduction**

  - Lew Myers, FENOC Chief Operating Officer

- **Management and Human Performance Root Causes**

  - Steve Loehlein, Root Cause Analysis Team Leader

- **Corrective Actions and Summary**

  - Lew Myers, FENOC Chief Operating Officer

Desired Outcome

Discuss the root causes:

- **Management Oversight**
- **Corrective Action Program**
- **Technical Rigor**
- **Program Compliance**

And the key corrective actions to be taken

Management Conclusions
Introduction

- Earlier Root Cause investigation and the NRC Augmented Inspection Team report both concluded that management had ineffectively implemented processes, and thus failed to detect and address plant problems as opportunities arose
- Root Cause Analysis Team was tasked to determine WHY the significance of the conditions in the plant was not recognized

Root Cause Team
Introduction

Team Composition

- Technical Root Cause Analysis Team Leader
- Root Cause Qualified FENOC Employees
- FENOC Oversight Support
- Process Expertise (Conger & Elsea)
- Davis-Besse Management Personnel

Industry Input

- Root Cause Process Experts
- Organizational Effectiveness Experts
- Organizational Development Consultants

Root Cause Team
Introduction

Root Cause Analysis Team

- Lead: Steve Loehlein (Beaver Valley)
- Bill Babiak (Perry)
- Mario DeStefano (Perry)
- Randy Rossomme (Beaver Valley)
- Lesley Wildfong (Conger & Elsea)
- Bill Mugge (Davis-Besse)
- Joe Sturdavant (Davis-Besse)
- Bobby Villines (Davis-Besse)
- Dick Smith (Conger & Elsea)
- Dorian Conger and Ken Elsea (C&E)
- Spyros Traiforos

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Root Causes

Steve Loehlein

Root Cause Analysis Team Leader

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Root Causes
Problem Statement

Understand why, over a period of years, Davis-Besse personnel failed to identify corrosion of the Reactor Pressure Vessel Head base metal

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Root Causes
Root Cause Statement

There was less than an adequate nuclear safety focus

- There was a focus on production, established by management, combined with taking minimum actions to meet regulatory requirements, that resulted in the acceptance of degraded conditions

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Root Causes

Investigation Process

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Root Causes

Approach

- Scope Development
  - Technical Root Cause results provided clues
    - Errors occurred over several years, and in several areas
    - Program effectiveness needed to be assessed
    - The potential for boric acid to cause damage was an issue for the plant in 1998/99, but actions taken then did not result in detection of head corrosion

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Root Causes

In-Depth Evaluations

- Event and Causal Factors chart and Barrier Analysis techniques used
- Management Oversight and Risk Tree (MORT) technique used
- MORT Analysis Sections
  - Technical Information Systems
  - Corrective Action Program
  - Hazard Analysis Process
  - Task Performance Errors
  - Management Support / Oversight

- Corrective Actions based on conclusions of data analysis

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Root Causes

Data Sources

- Technical Root Cause Analysis Report
- Interviews (more than 120)
- Documents (approximately 700)
- Over 20 years of Data

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Root Causes

Presentation Sequence of Data Analysis/Results

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Root Causes

Presentation Sequence of Data Analysis/Results

1. Boric Acid Corrosion Control and Inservice Inspection (ISI) Programs
2. Handling of Technical Information
3. Corrective Action Program
4. Hazard Assessment Process
5. Management Oversight/Risk Assessment

Root Causes

Boric Acid & In-Service Inspection Programs

- Hazard-Barrier-Target Analysis evaluated the Boric Acid Corrosion Control and Inservice Inspection (ISI) Programs
  - Model assumes that boric acid is the hazard, and the RPV head is the target
  - Barriers included design, training, inspection for leaks and corrosion, cleaning, and corrective actions (nearly 50 in all)

Root Causes

Conclusions

- The failure to clean the RPV head (a failed barrier in the analysis) prevented the team from analyzing the behavior that would have resulted had a bare head inspection been preformed
- The RPV head was not a focus in the process
- None-the-less, had the programs been followed as required, they were adequate to have prevented the serious head damage

Root Causes

Handling Technical Information

- Evaluated using MORT analysis technique
  - Evaluated the process the plant used to ensure that technical information was properly assessed and incorporated

Root Causes

Conclusion

- The process for disseminating and incorporating technical information was adequate
- Personnel failed to correctly apply key industry information and plant knowledge about the potential harmful effects of boric acid

Root Causes

Corrective Action Program

- Utilized MORT technique and Change Analysis
- Examined critical steps in process
  - Initiation
  - Operability Review/Categorization
  - Cause Analyses
  - Corrective Actions
  - Trending/Effectiveness Reviews

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Root Causes

Conclusion

- Davis-Besse adequately identified and documented nonconforming conditions
- Personnel at ALL levels did not effectively implement the Corrective Action Process
  - Operability/operational impact underestimated
  - Categorization did not recognize significance
  - Shallow cause analyses
  - Inadequate corrective actions
  - Inadequate trending of recurring equipment problems

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Root Causes

Hazard Assessment Process

- Evaluated using MORT analysis technique
- Examined how the organization used it to recognize and evaluate nuclear safety risks
- A key focus was on the application of the process for evaluating issues subject to 10CFR50.59, Safety Evaluations

Root Causes

Conclusions

- Hazard Analyses process contained the necessary elements to ensure the design and licensing basis was maintained
- Process that required detailed analysis became less restricted over time
  - Result was that in later years, the process was not applied to Containment Air Coolers, Radiation Monitor Filters, or boric acid on RPV head

Root Causes

Management Oversight/Risk Assessment

- Started from Technical Root Cause Analysis Report
  - Timeline of Key Events (Figure 26) from that report provides insight
  - Plant conditions provided clues that problem existed
    - * Reactor Coolant System unidentified leak rate
    - * Containment Radiation Monitor Filter plugging
    - * Containment Air Cooler cleaning frequency
    - * Boric acid accumulations on the head

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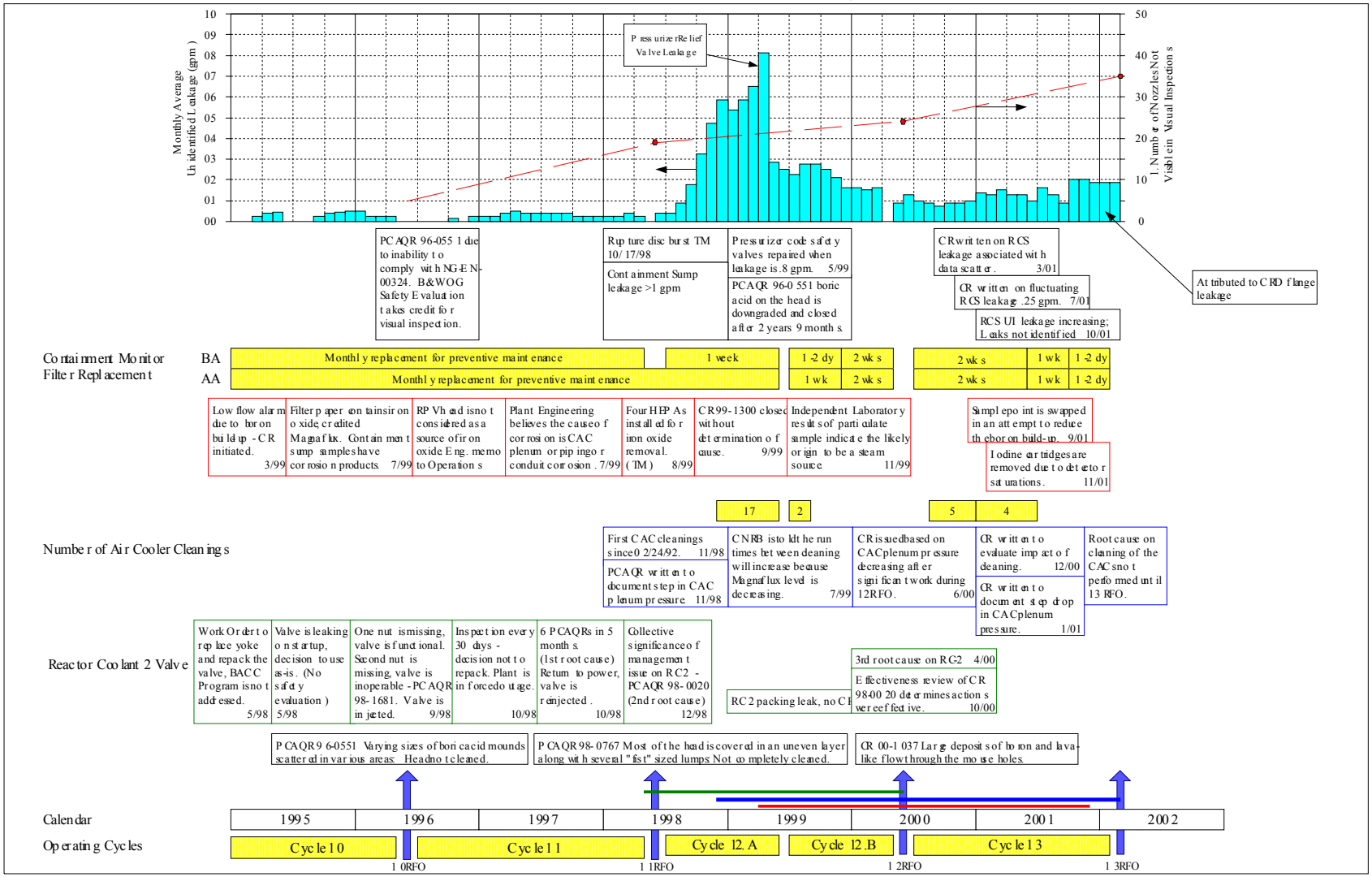
Root Causes

Management Oversight/Risk Assessment (continued)

- Examined 22 Condition Reports (PCAQRs & CRs)
  - Operability/operational impact underestimated by engineering and operations
  - Low categorization, with no root cause analysis required
  - Shallow cause analyses with focus on resolving symptoms rather than cause
  - Corrective Actions deferred resolution or treated symptoms
  - No collective significance recognized or evaluated; no visible senior management sponsorship

Timeline of Key Events



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Root Causes

<u>Why did the organization not recognize the significance of the plant condition?</u>

- Conclusions from other analyses were used to develop an overall understanding of failure to recognize significance of the plant condition
- Additional MORT analysis was done in Management Policy/Incentives
- Added numerous interviews insights

Root Causes

Conclusions

- Beginning in the mid-1990s, management focus was on production concerns
  - Rigor in assessing issues for their potential impact on nuclear safety diminished:
    - Taking minimum actions to meet regulatory requirements was interpreted to be adequate for nuclear safety
  - Management style was less directly involved, and relied on subordinates to escalate concerns

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Root Causes

Conclusions (continued)

- Results were:
  - Plant was restarted and run for extended periods with some degraded components
  - Personnel performed with the philosophy that issues were not serious unless they were proven to be
  - Rigor in processes declined at the same time that the threat of head damage increased

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Root Causes

Root Causes - Management Oversight

- A less than adequate nuclear safety focus and a production focus, combined with minimum actions to meet regulatory requirements

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Root Causes

Root Cause - Corrective Action Program

- Inadequate implementation of the Corrective Action Program:
  - Addressing symptoms rather than causes
  - Categorization did not recognize significance
  - Less than adequate cause determinations
  - Less than adequate corrective actions
  - Poor equipment trending

Root Causes

Root Cause - Technical Rigor

- Failure to integrate and apply key industry information and site knowledge/experience; and to compare new information to baseline knowledge

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Root Causes

Root Cause - Program Compliance

- Some steps in the Boric Acid Corrosion Control Procedure were not followed

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Root Causes

Root Cause - Contributing Causes

- Some decisions were made without considering the need for a safety analysis
- Corrective Action Program was not state-of-the-art

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Root Causes

Other Key Observations

- Alloy 600 material used in the original design of the CRDM nozzles was susceptible to cracking/leakage; the original gaskets in the CRDM flanges were susceptible to leakage
- Training was not provided to individuals performing inspections for boric acid
- Inspections activities and corrective action were not coordinated through the Boric Acid Corrosion Control (BACC) Coordinator
- BACC Procedure did not specifically reference the CRDM nozzles as one of the probable locations of leakage

Root Causes

Other Key Observations (continued)

- Condition Reports associated with the boric acid issues tended to stay unresolved until significant degradation occurred
- There was little evidence of QA's involvement and the documented findings by QA were of mixed quality
- Monetary incentive program rewards production more than safety at senior levels
- Written policies do not support a strong safety focus
- Operations had minimal involvement
- Management had minimal entries into containment

Corrective Actions

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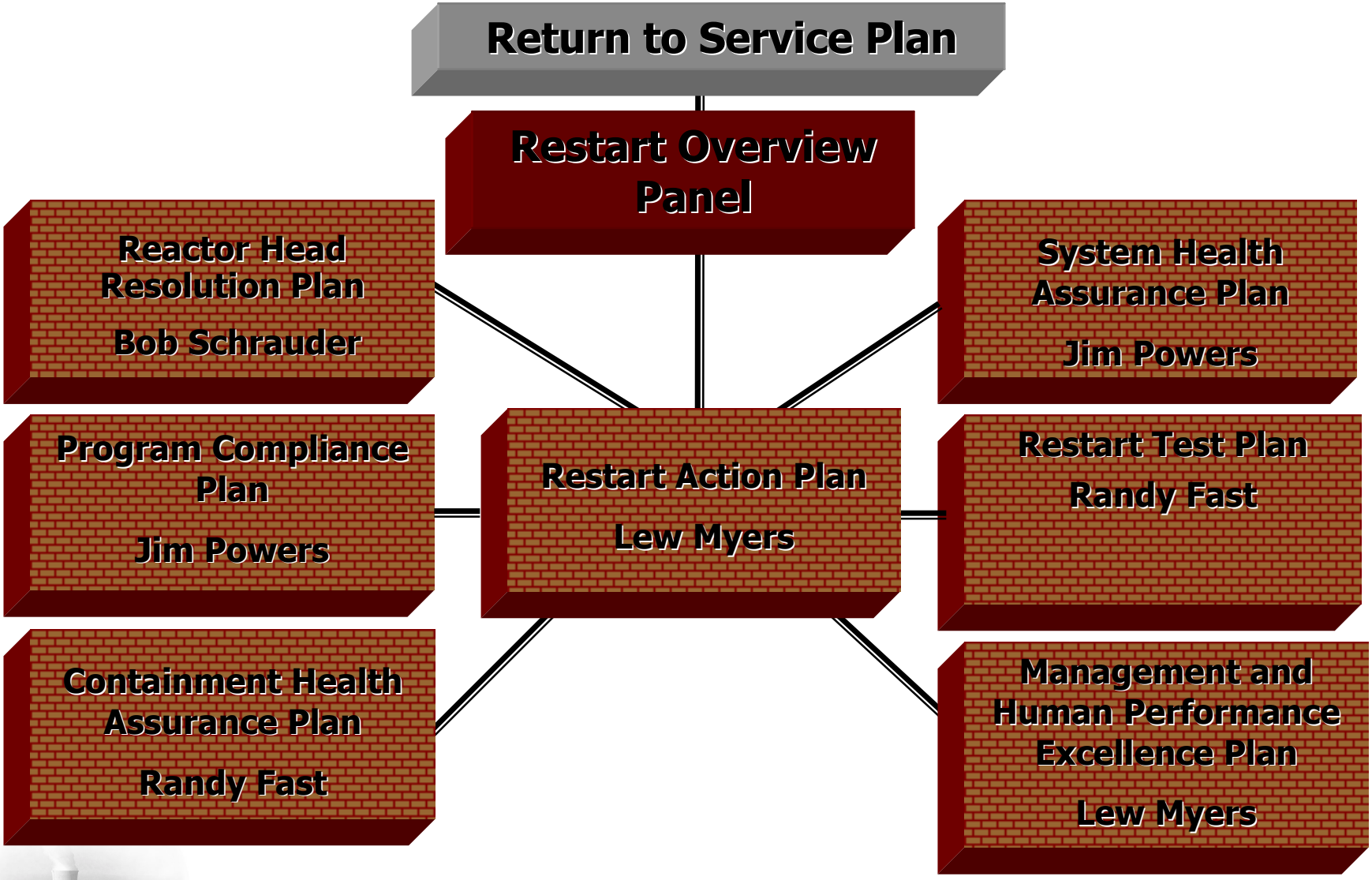
Corrective Actions

Extent of Condition

Davis-Besse Building Blocks ensure adequacy of systems, programs, and the organization to support safe and reliable operation.
Specifically:

- The System Health Assurance Plan provides for rigorous system reviews
- The Management and Human Performance Excellence Plan will ensure a strong and sustained safety focus
- The Program Compliance Plan ensures programs meet industry high standards of performance

Corrective Actions



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Management Oversight/ Nuclear Safety Focus

Corrective Actions

- New Senior Management Team with high standards
- Implement the Management and Human Performance Excellence Plan
- Case Study Training and Rebaselining of Standards (how the event happened, what barriers broke down, and what needs to be different in the future)
- Safety Conscious Work Environment Survey and Assessment
- Organization Effectiveness
- Four Cs (Compliments, Communications, Concerns, and Changes) Management (Structured Approach)
- Management Observation Program
- Evaluation of Directors and Managers

Corrective Action Program

Corrective Actions

- Complete a Program Compliance Plan which includes a detailed latent issues review of Corrective Action Program by outside consultants
- Strengthen the Corrective Action Review Board to enforce higher standards for cause evaluations and effective corrective action (chaired by Plant Manager or another director-level individual)
- Ensure criteria used for categorization of significant or repeat equipment failures are appropriate and utilized by plant personnel
- Routinely perform assessments of categorization

Corrective Action Program

Corrective Actions

- Repeat conditions are to be treated as Significant Conditions Adverse to Quality (SCAQ)
- Review existing long-standing issues for possible SCAQ categorization and use root cause evaluation techniques to obtain resolution
- Require the use of formal cause determination techniques for root and basic cause evaluations to ensure analytical rigor is applied
- Define and implement training for cause evaluations
- Improve guidance on reviews of the effectiveness of corrective actions (focus on verifying causes have been fixed and provide training on revised guidance)
- Implement an effective site-wide equipment trending program

Technical Rigor of Programs

Corrective Actions

- Rebaseline Standards and Expectations in each FENOC Group
- Establish Engineering Assessment Board to reinforce standards
- Establish FENOC hierarchy of documents for consistent standards for analyses of safety issues
- Establish a Periodic System Walk-down Program
- Establish a Periodic Engineering Program Review Process

Procedure Compliance

Corrective Actions

- Provide training to applicable personnel and managers that includes:
  - Need to remove boric acid from components
  - Inspect for signs of corrosion
  - Perform inspections for signs of boric acid in component internals
- Reinforce standards and expectations for procedure compliance and the need for work-practice rigor
- Implement Management Observation Program with weekly schedules (used at Perry and Beaver Valley)
- Perform independent assessments of procedure compliance
- Discuss procedure compliance regularly at morning meeting

Contributing Causes

Corrective Actions

- Establish the FENOC decision-making process at Davis-Besse, including hazard analyses
- Perform Corrective Action Procedure Benchmarking

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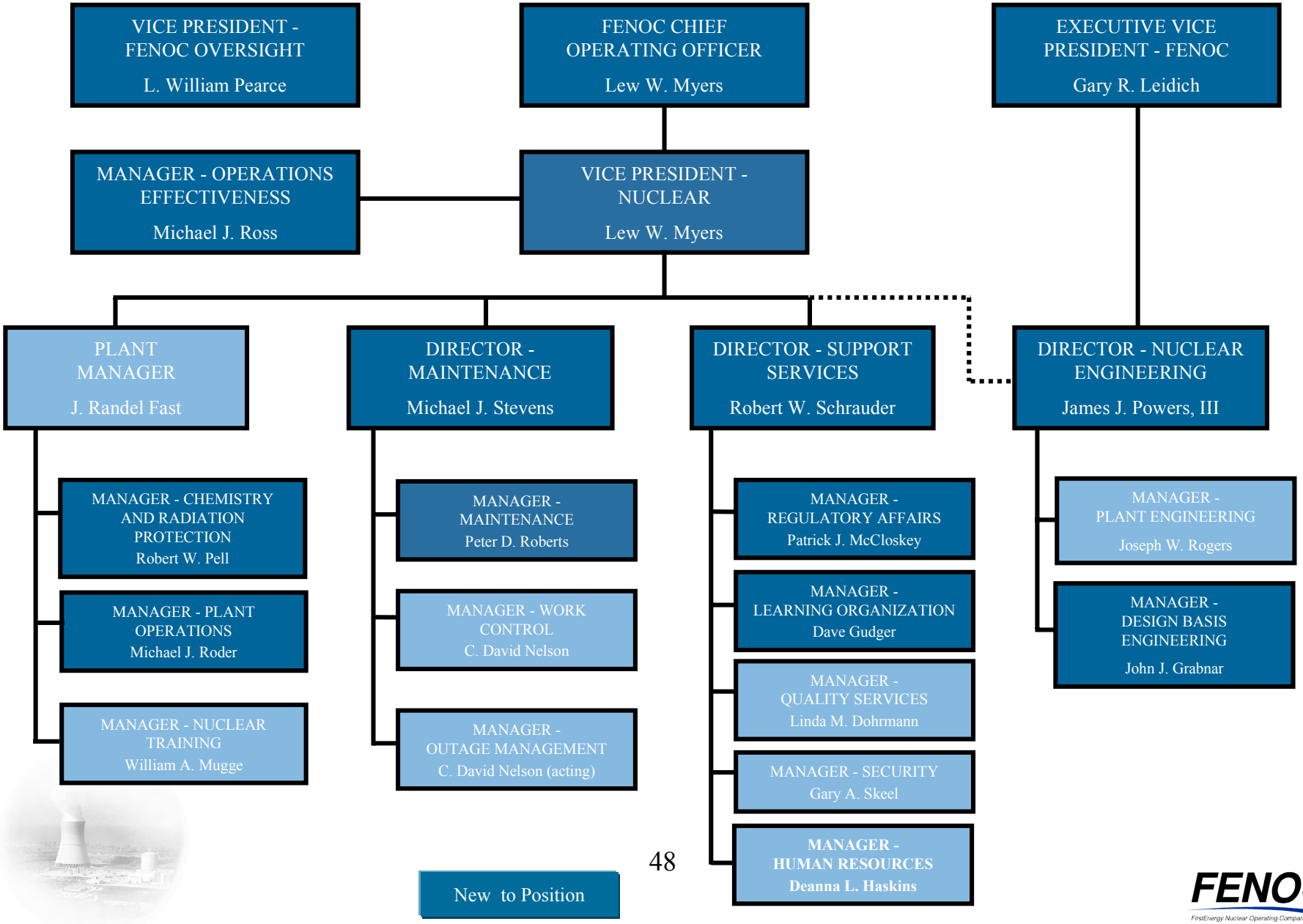
Other Relevant Corrective Actions and Improvements

- Design of New RPV Head
- BACC Procedure Revision to include CRDM Nozzles
- Training on BACC Procedure
- Coordination of Boric Acid Control Activities
- Timely Corrective Action Resolutions
- Reviews of Quality Assurance Audits and Surveillances Adequacy
- Realign Incentive Program to Increase Focus on Safety
- Establish Policies to Support Safety
    - Operations involvement
    - Management presence in the field

Davis-Besse Site Organization



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Summary

CEO of FirstEnergy
has set the standard of returning Davis-Besse
back to service in a safe and reliable manner,
and doing the job right the first time.
We are committed to meeting this challenge.

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