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September 15, 2008

L-08-251

Mr. James L. Caldwell, Administrator  
United States Nuclear Regulatory Commission  
Region III  
2443 Warrenville Road, Suite 210  
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Subject:

Davis-Besse Nuclear Power Station, Unit 1  
Docket Number 50-346, License Number NPF-3  
Submittal of the 2008 Independent Assessment Report of the Corrective Action  
Program Implementation at the Davis-Besse Nuclear Power Station

The purpose of this letter is to submit the assessment report for the 2008 Independent Assessment of the Corrective Action Program implementation at the Davis-Besse Nuclear Power Station (DBNPS). This submittal is in accordance with the Nuclear Regulatory Commission (NRC) letter dated March 8, 2004, "Approval to Restart the Davis-Besse Nuclear Power Station, Closure of Confirmatory Action Letter, and Issuance of Confirmatory Order," which requires submittal of the assessment results within forty-five (45) days of the completion of the assessment. The 2008 Corrective Action Program Implementation independent assessment fulfills the requirement of the March 2004 Confirmatory Order and is the final year this assessment is required by that Order.

The on-site activities of the Corrective Action Program Implementation Independent Assessment were conducted from July 7 through July 18, 2008, in accordance with the Assessment Plan, submitted via DBNPS letter number L-08-110, dated April 8, 2008, with one exception.

On July 3, 2008, the DBNPS received notification from Advanced Technologies and Laboratories team leader that one of the industry peer team members was unable to participate in the assessment. The NRC Region III offices and the NRC Resident Inspector's office were promptly notified of this change in the Assessment Plan. An attempt to recruit a replacement third peer was

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unsuccessful. The team leader felt a thorough and accurate assessment could be completed with two industry peers in the same time period allocated in the assessment plan.

The final debrief of the assessment results was conducted with DBNPS management on August 1, 2008, marking the end of the assessment. The enclosed report contains the results of the Independent Assessment. No issues rising to the level of an Area for Improvement were identified in the Independent Assessment; therefore, no action plans are included to address Areas for Improvement.

There are no regulatory commitments included in this letter. If there are any questions or if additional information is required, please contact Mr. Dale R. Wuokko, Manager – Site Regulatory Compliance, at (419) 321-7120.

Sincerely,



Barry S. Allen

LJS

Enclosure:

Assessment Report - Independent Assessment of the Corrective Action Program Implementation at Davis-Besse Nuclear Power Station

cc: USNRC Document Control Desk  
DB-1 NRC/NRR Project Manager  
DB-1 Senior Resident Inspector  
Utility Radiological Safety Board

**Enclosure  
L-08-251**

**Independent Assessment of the  
Corrective Action Program Implementation  
at Davis-Besse Nuclear Power Station**

**Report Number COIA-CAP-2008**

**August 11, 2008**

**(73 pages follow)**

# Independent Assessment of the Corrective Action Program Implementation at Davis-Besse Nuclear Power Station

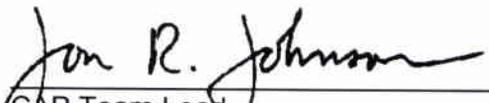
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July 7 to July 18, 2008

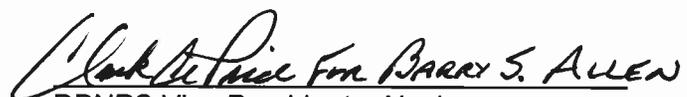
**Team Members:**

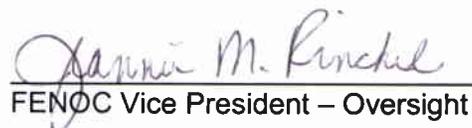
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## ACRONYMS

AA	Condition Adverse to Quality – Full Apparent Cause
ACE	Apparent cause evaluation
AF	Fix level
AFI	Area for Improvement
AFW	Auxiliary feed water
AL	Condition Adverse to Quality – Limited Apparent Cause
ANA	Area in Need of Attention
ANO	Arkansas Nuclear One
B&W	Babcock and Wilcox
BACC	Boric acid corrosion control program
BVOV	Beaver Valley Oversight
BWST	Borated Water Storage Tank
CA	Corrective Action
CAP	Corrective Action Program
CAQ	Condition Adverse to Quality
CARB	Corrective Action Review Board
CCW	Component cooling water
CFT	Core flood tank
CHP	Chemical Hygiene Plan
CHT	Component Health and Trending
CNRB	Company Nuclear Review Board
COIA	Confirmatory Order Independent Assessment
CR	Condition Report
CREST	Condition Report Evaluation and Status Tracking
CREVS	Control room emergency ventilation
CTMU	Cooling Tower Make-up
DB	Davis-Besse
DBBP	Davis-Besse Business Practice
DOV	Davis-Besse Oversight
DH	Decay heat removal
ECCS	Emergency Core Cooling System
ECP	Employee Concerns Program
ECR	Engineering Change Request
EDG	Emergency diesel generator
EFP	Electrical fire pump
EPRI	Electric Power Research Institute
ER	Effectiveness Review
EWR	Engineering Work Request
FAC	Flow Accelerated Corrosion (Program)
FACE	Full apparent cause evaluation
FENOC	First Energy Nuclear Operating Company
FITS	FENOC Integrated Training System

FME	Foreign material exclusion
GE	General Electric Company
HPFW	High Pressure Feed Water
HPI	High pressure injection
HRA	High-radiation area
IN	Information Notice
INPO	Institute of Nuclear Power Operations
IP	Inspection Procedure (NRC)
IPA	Integrated Performance Assessment
JFB	Job Familiarization Guidelines
LACE	Limited apparent cause evaluation
LEFM	Leading edge flow meters
MAOM	Management Alignment and Ownership Meeting
MDT	Maintenance deficiency tag
MR	Maintenance Rule
MRB	Management Review Board
MRFF	Maintenance Rule Functional Failure
MTSV	Master trip solenoid valve
MU	Make-up
NCV	Non-cited violations
NDE	Non-destructive examination
NOBP	Nuclear Operations Business Practice
NOP	Nuclear Operating Procedure
NRC	U.S. Nuclear Regulatory Commission
OE	Operating Experience
OEO	Operations Evolution Order
PI	Performance improvement
PIU	Performance Improvement Unit
PM	Preventive maintenance
PRA	Probabilistic Risk Assessment
PYOV	Perry Oversight
QA	Quality Assurance
RCE	Root cause evaluation
RCP	Reactor Coolant Pump
RCS	Reactor Coolant System
RP	Radiation protection
SAC	Station ALARA Committee
SAP	Activity tracking database
SCAQ	Significant Condition Adverse to Quality

SCWE	Safety Conscious Work Environment
SDRRT	Shutdown Defense in Depth Review Team
SFAS	Safety Features Actuation System
SOER	Significant Operational Event Report
SPS	Safety Precedence Sequence
SR	Significant Condition Adverse to Quality – Root Cause
SR CR	Significant Root Causes Condition Reports
SRO	Senior Reactor Operator
SUT	Start up transformer
SW	Service water
TS	Technical Specification
UTV	Ultrasonic void test
WANO	World Association of Nuclear Operators

## EXECUTIVE SUMMARY

This is a report of the 2008 Independent Assessment of the Corrective Action Program (CAP) at the Davis-Besse Nuclear Power Station.

The assessment was conducted on-site during a two-week period in July 2008 by a team of three consultants and two peer evaluators.

### Overall Program

Based on the definitions in Davis-Besse Business Practice DBBP-VP-0009, "Management Plan for Confirmatory Order Independent Assessments," the Team assigned Davis-Besse's implementation of the CAP an overall rating of EFFECTIVE. This rating is based on interviews, document reviews, and observations.

### Assessment Areas

The following summarizes the rating of each assessment area. Additional details are found in the body of this report.

Area	Title	Team Finding
1	Identification, Classification, and Categorization of Conditions Adverse to Quality	EFFECTIVE
2	Evaluation and Resolution of Problems	EFFECTIVE
3	Corrective Action Implementation and Effectiveness	EFFECTIVE
4	Trending Program Implementation and Effectiveness	HIGHLY EFFECTIVE
5	Effect of Program Backlogs	HIGHLY EFFECTIVE
6	Effectiveness of Internal Assessment Activities	EFFECTIVE
7	Effectiveness of Corrective Actions from Previous Independent Assessments of the Davis-Besse Corrective Action Program	EFFECTIVE

**Area 1: The Identification, Classification, and Categorization of Conditions Adverse to Quality** was rated as EFFECTIVE. Davis-Besse Condition Reports (CRs) were clearly written, and their classification and categorization were in accordance with the program guidance. The initial steps of writing timely, accurate CRs were validated with the exception of the seal leakage found on Decay Heat (DH) Pump 2 that had not been entered into the CAP. Interviews with Davis-Besse staff members at every level revealed a strong commitment to the CAP program. The Team's review of SAP non-maintenance notifications and the FENOC Integrated Training System (FITS) did not reveal notifications that involve adverse conditions not already associated with a CR. The process for reporting operational experience to the industry was considered an *Area of Strength*. The Team identified two instances where CR classification in accordance with program guidance did not meet the Team's expectation of comprehensive evaluation of serious events.

An *Area in Need of Attention* was identified involving inappropriate downgrading of the level of cause evaluation for a vendor error that caused a significant extension of a refueling outage.

**Area 2: The Evaluation and Resolution of Problems** was rated as EFFECTIVE. The Team determined that Davis-Besse demonstrated a very good understanding of evaluation and problem resolution methodologies; however, cause evaluation guidelines do not include explicit safety culture attributes for evaluation. Good evaluations were noted on feedwater heater tube problems and the leading edge flow meter issues. The cause of pipe cracking in alloy 600 materials was not definitively determined because a boat sample was not taken of the affected area.

Two *Areas in Need of Attention* were identified: (1) the cause evaluation and corrective actions for recurrent tripping of the control room emergency ventilation (CREVS) compressor were not effective in preventing a subsequent failure; and (2) there were three examples where the cause evaluation and corrective action for human error issues were weak because the corrective actions were not implemented at a sufficiently high safety precedence to assure effective long-term prevention.

**Area 3: The Corrective Action Implementation and Effectiveness** was rated as EFFECTIVE. The Team determined that, in general, Davis-Besse adequately identified the causes of adverse conditions and successfully carried out corrective actions. No major adverse condition repeats were identified. The Corrective Action Review Board (CARB) was effective in assuring the quality of CRs and assured that corrective actions were completed. Correcting leading edge flow meter (LEFM) issues was considered an *Area of Strength*.

One *Area in Need of Attention* was identified. CR 08-36633, concerning chemical laboratory practices, must include corrective actions to address the identified human performance-related causes of personnel not adhering to or being aware of procedural requirements and reduced management oversight in the workplace.

**Area 4: The Trending Program Implementation and Effectiveness** was rated as HIGHLY EFFECTIVE. Davis-Besse trending processes continued to provide valuable information. CRs were written when an adverse trend became apparent; management attention to adverse trends was resulting in proactive corrective actions. The Integrated Performance Assessment (IPA) process and the Plant Health quarterlies are working well, with the timely identification of adverse trends. These are considered *Areas of Strength*. Component trending needs further work to be effective.

One *Area in Need of Attention* was identified. The Component Health & Trending plots contain errors requiring correction; further experience is needed to develop window color criteria and to provide trending determinations with confidence; and the addition of component failure data is required to satisfy objectives of First Energy Nuclear Operating Company (FENOC) procedures.

**Area 5: The Effect of Program Backlogs** was rated as HIGHLY EFFECTIVE. The Team determined that the station performance in addressing the backlog of old CRs continued to show improvement. Current total numbers of “open documents” representing the global amount of work can be maintained while being able to focus on current day to day issues. A recent self-assessment provided a summary used for justification to close the *Open Condition Report Gap Closure Plan*. Interviews continue to support management support of and attention to the backlog. Peer reviews indicate that management expectations and standards can continue to be raised compared to industry standards. The low number of Operator Workarounds and Burdens as well as Control Room Deficiencies is considered an *Area of Strength*.

**Area 6: The Effectiveness of Internal Assessment Activities** was rated as EFFECTIVE. The Team concluded that Davis-Besse is effectively identifying and resolving CAP issues that are identified during audits and assessments. The Team determined that there is indication that the station’s focus on the CAP has been reduced. The Oversight organization did not assign the CAP a Performance Assessment Rating for three quarters in 2007 due to not assessing the program sufficiently enough to assign a rating. The

Team considers the detail, quality, and management support of the self-assessment process to be a significant contributor to achieving excellence at Davis-Besse.

The reduction in Oversight (QA) focus on CAP program review and reporting of results in the quarterly Oversight Report "Performance Assessment Ratings" is considered an Area in Need of Attention.

**Area 7: Effectiveness of Corrective Actions from Previous Independent Assessments of the Davis-Besse CAP** was rated as EFFECTIVE. The Assessment Team reviewed the actions taken in response to open Areas in Need of Attention from prior assessments and closed all of the open issues.

#### **Overall Conclusion**

The Confirmatory Order Independent Assessment Team concluded that the Davis-Besse site continued to demonstrate a strong commitment to the CAP, which was being effectively implemented. All individual elements of the CAP were assessed as either EFFECTIVE or HIGHLY EFFECTIVE, and the site management continued to place focused attention on the backlog as well as the day-to-day aspects of the program. Ownership of corrective actions by individual managers was specifically noted.

Specific findings and observations, however, also demonstrate that continued attention to fundamentals of the CAP program, as well as consideration of benchmarking performance indicators and expectations based on industry standards, is appropriate. In reviewing the backlog, several corrective actions were to replace obsolete equipment. Site management should prepare for the expected increase in plant engineering design changes brought on by equipment obsolescence. The Team noted the substantial increase in resources required when replacing old equipment with new as compared with simply replacement-in-kind.

## **1.0 INTRODUCTION**

This Independent Assessment of the Davis-Besse Corrective Action Program (CAP) was conducted at the request of the Davis-Besse Nuclear Power Station's Vice President – Nuclear. The Team used the general guidance of Nuclear Operations Business Practice NOBP-LP-2001 Rev 09, "FENOC Focused Self-Assessment/Benchmarking;" NRC Inspection Procedure IP 71152, "Identification and Resolution of Problems;" NRC IP 40500, "Effectiveness of Licensee Process to Identify, Resolve, and Prevent Problems;" Nuclear Operating Procedure NOP-LP-2001 Rev 15, "Corrective Action Program;" and DBBP-VP-0009 Rev 03, "Management Plan for Confirmatory Order Independent Assessment," to evaluate the effectiveness of the implementation of the CAP.

## **2.0 SCOPE OF ASSESSMENT**

The Team evaluated the following areas associated with the Corrective Action Program (CAP) implementation:

1. Identification, Classification, and Categorization of Conditions Adverse to Quality
2. Evaluation and Resolution of Problems
3. Corrective Action Implementation and Effectiveness
4. Trending Program Implementation and Effectiveness
5. Effect of Program Backlogs
6. Effectiveness of Internal Assessment Activities
7. Effectiveness of Corrective Actions from Previous Independent Assessments of the Davis-Besse CAP

This section reports the Team's evaluation of each of these areas. Condition Reports (CRs) having corrective actions were reviewed for areas 1, 2, and 3 above and so appear in Sections 2.1, 2.2, and/or 2.3.

### **2.1 Identification, Classification, and Categorization of Conditions Adverse to Quality**

The 2008 Independent Assessment Team reviewed activities for issues identified since the 2007 Independent Assessment of the Davis-Besse CAP (August 2007), including:

- a. Review and evaluate the identification, classification, and categorization of selected CRs categorized after Management Review Board (MRB) review.
- b. Review a sampling of SAP non-maintenance notifications initiated since the 2007 Independent Assessment of the Davis-Besse CAP (August 2007) to determine if the conditions were properly categorized. Analyze for issues that should have been identified as Conditions Adverse to Quality, but were not or were only partially identified.
- c. Interview individuals from various parts of the Davis-Besse Nuclear Power Station's management and staff. Ascertain the Davis-Besse Nuclear Power Station staff's commitment to

the CAP, the extent of their understanding of the Davis-Besse Nuclear Power Station's problem identification process, and their willingness to report problems.

- d. Evaluate the adequacy of the Davis-Besse Nuclear Power Station's identification, classification, and categorization of corrective actions for sharing operational experience feedback with the industry.
- e. Review a sampling of in-plant logs (e.g., control room log) and records to verify that conditions adverse to quality are captured appropriately in the CAP.

### **2.1.1 Evaluation of the Identification, Classification, and Categorization of Condition Reports Categorized as Adverse Conditions**

#### **CR 08-34786, High Vibrations on Generator Bearing 7**

During main turbine roll on 2/1/2008, a high vibration was noted on Generator Bearing 7. The vibration was caused by the vendor [General Electric (GE)] improperly repairing a generator component during a shop re-wind activity. A damaged copper amortisseur segment (23 lbs) was replaced with an aluminum one (7 lbs), which resulted in the imbalance during testing. Operators tripped the turbine due to high vibration.

The CR was initially categorized as an adverse condition with a root cause evaluation (RCE) assigned. The CR was downgraded to a limited apparent cause evaluation (LACE) on 2/22/2008 when the cause was assumed to be related to vendor activities off-site. A complete set of aluminum segments was installed, and the generator was successfully restarted.

The Team determined that the downgrade to a LACE was not appropriate. Although this work was non-safety related, the guidance in CAP program procedure NOP-LP-2001, Attachment 2, page 1 specifies at least a full apparent cause evaluation (FACE) for those events where the consequences and risks of recurrence are not acceptable. The CR shows that the consequence of the error included an almost two-week refueling outage extension, which would not be acceptable to recur and therefore, the classification downgrade was inappropriate. At a minimum, the resources lost due to such an error could have been utilized to fund correction of several existing low priority safety related equipment deficiencies. Additionally, the CR states that there are no other "transportability" issues. The Team found that Davis-Besse should review other potential vulnerabilities where they procure significant equipment or services in this manner. A FACE should have produced a more thorough Generic Implications review. At least it appears that Davis-Besse should have a corrective action to review the results of GE's cause investigation and corrective actions for extent of condition. The inappropriate downgrade and weak extent of condition for this CR is an **Area in Need of Attention**.

#### **CR 08-37319, Electrical Near Miss While Installing Fence Post**

On 3/26/2008, while drilling a hole for a security fence post, an electrical conduit was struck. The conduit contained energized 480V cables. A C-phase cable was damaged and its fuse was blown. There were no injuries. Contractor workers digging the post hole noticed auger vibration and stopped. They determined that they had hit an underground conduit. Work was stopped and the Shift Manager and Project Manager were informed. Immediate actions included investigations by both the Rapid Response Team and the Fix It Now Team. The cables in the conduit were de-energized and tagged out and plant management was notified of the event.

This CR was categorized as an adverse condition requiring a FACE. The FACE concludes that the toning (method used to detect buried metal lines) contractor used only dots to mark the locations of buried lines. This type of marking was found to be ambiguous and did not clearly indicate the exact run of the conduit in question. An additional cause involved the failure to verify the toning indications with plant drawings. The drawings indicated the existence of the conduit in question, but its as-built location was not shown on the drawing. Human performance issues were also indicated as causal factors involving the mistaken assumption by both project and toning contractor personnel that all the underground lines ran north/south, which was not the case for the conduit in question. Over-confidence by those involved was also a factor, resulting in the lack of a questioning attitude during the pre-job brief and walkdown.

A Safety Awareness bulletin was issued and distributed throughout FENOC on 4/1/2008. Other corrective actions were developed including the following:

1. Human performance Section Clock reset to remediate personnel errors.
2. NOP-WM-4007, "Excavating and Trenching," is being developed by Fleet Maintenance to incorporate all the lessons learned from this near miss event.

The initial evaluation was presented to the Corrective Action Review Board (CARB) on 6/2/2008. The evaluation was rejected. The following actions were required:

1. Add to the CAUSE ANALYSIS a discussion of the pre-job brief, interpretation of the toning marks, method of toning (general versus specific area), reconciliation of drawings/toning marks/precautionary action sheets, and auger grounding.
2. Add to the CAUSE ANALYSIS the corrective action applicability to Construction Services personnel.
3. Correct alignment of causes among the CAUSE ANALYSIS and corrective actions.
4. Clarify in the CAUSE ANALYSIS the applicability of Management Issues.
5. Identify the resolution for information missing from the associated design drawings.
6. Add titles to clarify the purpose of the Attachments.
7. Include a Barrier Analysis.

The resulting modified evaluation was signed by management on 7/3/2008 and was scheduled to be resubmitted to CARB on 7/21/2008.

The Team determined that this event was categorized in accordance with CAP guidance in NOP-LP-2001. However, the Team found that such an event that involved an electrical near miss with the potential for serious worker injury or death would require a RCE at many facilities. A RCE is generally performed at the significant condition adverse to quality (SCAQ) level. Although the CR classification guidance was benchmarked against three other utilities, the Team observed that the guidance should be revalidated against industry standards to assure that events with potential industrial safety consequences are consistently categorized.

The Team also found that the CR description was clear and the immediate responses to the event were effective and timely. Following CARB improvements, the FACE was detailed and thorough; the analysis

results were justified; and the corrective actions, to date, were adequate, noting that NOP-WM-4007, "Excavating and Trenching," was yet to be completed (due date of 7/24/2008). The Team noted this as an example where CARB provided clear value added to this evaluation.

#### **CR 08-38135, Surveillance Requirements for Source Range Nuclear Instruments**

This CR is categorized as a Condition Adverse to Quality – Limited Apparent Cause (AL) [downgraded from SCAQ – Root Cause (SR)] and identifies concerns with the performance of the current channel calibration for Reactor Protection System source range nuclear instrumentation (NI's 1 and 2). The issue raises a concern that literal compliance with the surveillance requirements per SR 4.3.1.1.1 were not being met as the requirements exclude the source range neutron detector, but did not exclude the pre-amplifier (located in containment) which is not tested per the aforementioned calibration procedures.

Davis-Besse reviewed this event in accordance with NOP-LP-2100, step 4.8.1 and it was determined that issuance of an Operating Experience (OE) Report was not required. During the initial investigation, the remaining Babcock and Wilcox (B&W) plants [Oconee, Three Mile Island, Arkansas Nuclear One (ANO), and Crystal River] were contacted regarding their Technical Specification (TS) surveillance requirements for source range preamplifiers. Oconee, Three Mile Island, and ANO had previously replaced their source range instrumentation with Gamma-Metrics source range instrumentation that allows periodic testing and calibration. Crystal River had previously revised their TS bases to specifically exclude calibration of the source range pre-amplifier; therefore, this event is not applicable to other facilities. Based on discussions with the remaining B&W plants, the original source range has either been replaced with instrumentation that can be calibrated or calibration of the preamplifier has been excluded in the TS bases; therefore, this event did not impact the other B&W plants and no OE report was required.

The cause of the event was determined to be the original inferred latent error associated with industry/regulatory guidance that was followed when preparing TSs in April 1977.

The Team found that the description of the CR was clear, the categorization was appropriate, and the evaluation was appropriate. Davis-Besse utilized good follow up and investigation in determining that issuance of an OE report to the Industry was not required. Downgrade of the CR category from SR to AL was based on risk assessment and safety consequence. Sufficient objective evidence was included in the apparent cause and investigation summary of the event to aid in determining the proper course of corrective actions.

#### **CR 07-26233, Incorrectly Labeled Oil Received From the Warehouse**

This CR was categorized as an adverse condition evaluated at the Fix level (AF) to document a batch of oil delivered from the warehouse with the wrong label (Dextron 2 vs. Dextron 3). The mislabeling was identified prior to use and the oil was quarantined until it was confirmed that they were equivalent products. Corrective actions included updating stock records and re-labeling the product.

The Team found the CR category and evaluation method acceptable. The decision not to write an OE report was appropriate, and the implementation of corrective actions was acceptable.

#### **CR 08-35591, Previous Safety Concern CR Closed Without Adequately Addressing Issue**

This AF CR identified a need to follow up and document safety concerns described in another CR (08-33798) to assure that lessons learned are shared with the industry regarding control of hazardous vapors and combustible materials and to assure that Davis-Besse internal programs are revised as appropriate. Notifications were issued to update the chemical control and industrial safety programs.

The Team found the CR category and evaluation method acceptable. The decision to write an OE report was appropriate, and the implementation of corrective actions was acceptable.

#### **CR 07-25151, Tritium Activity Confirmed in Previously Sampled Groundwater Monitoring Wells**

This AF CR documented, on 8/14/2007, the results of confirmatory samples of groundwater sample wells which detected small concentrations of Tritium. This program was a result of implementing a new Nuclear Energy Institute industry initiative to sample for Tritium and provide informal notification to local officials and the U.S. Nuclear Regulatory Commission (NRC). Future monitoring is planned to be included in the annual radiological environmental monitoring report.

The Team found the CR category and evaluation method acceptable. The decision not to write an OE report was appropriate, and the implementation of corrective actions was acceptable.

#### **CR 07-25133, Errors with Analysis and Reporting of RCS Stripped Gas**

This CR identified, on 8/14/2007, an erroneous reporting of fission product chemistry analysis in the liquid portion of a stripped gas sample. A recent change had been made to analyze the liquid portion in addition to the gas sample. The sample had been allowed to decay for three hours, which gave erroneous results when the ratio of Xe 133/Xe 135 was reported. DB-HP-01113, "Countroom Analysis System (CAS) Operation," allows a maximum decay time of 1.5 hours for the gas portion of a stripped gas sample, but provides no decay time limit for the liquid portion. The CR was categorized as an AF and a review was conducted for OE and clock reset applicability.

An evaluation concluded that the applicable procedure, DB-HP-01113, did not provide specific guidance concerning the allowable decay time for the liquid portion of the stripped gas samples. The procedure has been revised to clarify the need for counting both the liquid and gas portions of the sample within 1.5 hours.

The Team found that the human performance elements were appropriately evaluated and Human Performance System Enhancement codes for inadequate change management and deficient self-checking were determined. The Team found the CR category and evaluation method acceptable. The decision not to write an OE report was appropriate, and the implementation of corrective actions was acceptable.

#### **CR 07-25026, Adverse Trend in LEFM Meter 1 Path 2 Reject Rate**

This CR involved several Leading Edge Flow Meters (LEFMs) in the main feedwater system experiencing acceleration in the data reject rates involving one or several of their acoustic paths on 8/13/2007. Operating experience from past failures indicates path failure may occur within a short time.

Order 200277970 replaced the meter paths in question and the LEFM system was returned to service on 8/16/2007; an OE report was released on 8/31/2007.

The event was properly categorized as AL, and the MRB assigned a limited apparent cause to be performed. The CR analysis indicates that from discussions with the manufacturer, Cameron, transducer de-poling is a likely cause with Cameron recommending a different model transducer.

The final implementation of CA 1 for this CR is dependent on tracking of a final vendor report, Cameron's (formerly Caldon) report on the probable cause of data drift, via 07-19158 CA 3. The final OE report required by this CA is being tracked via CR 07-19158 CA 4.

The Team found that the description was related to several other CRs and was somewhat complicated (07-19158, 07-23577, and 07-25074). The only corrective action was to determine whether an OE report should be issued to Industry. This was done via another CR 07-23577 Corrective Action (CA) 1 as OE 25372.

The Team found the CR category and evaluation method acceptable. The decision to write an OE report was appropriate, and the implementation of corrective actions was acceptable.

#### **CR 07-25074, Caldon System Trouble Alarm 10-4-A**

This CR identified, on 8/14/2008, a similar event related to the LEFMs provided by Caldon to measure feed water flow. An unexpected trouble alarm was received, which required the operators to remove the system from service and replace the inputs from the feed water venturiers. This necessitated a reduction in reactor power level. The CR was categorized as an AL, and the determination was made to replace the transducers. This was also evaluated to be a Condition Monitoring failure of the Non-nuclear Instrumentation system and discussions were held with the vendor.

The CR details documented were essentially duplicated from those of CR 07-25026 above and both have the same corrective action for a final OE report tracked by CR 07-19158. The apparent cause was attributed to “de-poling” of the transducer as described above.

The Team found the CR category and evaluation method acceptable. The decision to write an OE report was appropriate, and the implementation of corrective actions was acceptable.

#### **CR 07-19158, Caldon System Trouble Alarm 10-4-A**

This CR identified, on 4/24/2008, an unexpected trouble alarm and the operators took the system out of service, using the feed water venturi until repaired. This was the “major” CR which tracked the Cameron (formerly Caldon) lab tests and RCE, and the final OE report to industry.

The newly modified transducers were replaced into meter #2 in November 2007, and Davis-Besse properly decided to observe performance before replacing meter #1 transducers. Train 1 was replaced in April 2008 and has been observed to be operating reliably since then.

The final OE report to industry was issued in December 2007 upon receipt and review of the Cameron RCE.

The Team identified that the CR was categorized properly, that the cause evaluation was thorough and used the expertise of the vendor, and that the corrective actions were timely and appropriate. In addition, since the vendor implemented and Davis-Besse installed the modified transducers, there have not been any more distraction alarms for the control room operators.

#### **CR 07-25993, Inadequate SW Flow Through CCW Heat Exchanger #1**

On 8/31/2007, Davis-Besse discovered that the SW outlet valve from component cooling water (CCW) heat exchanger #1 had been mis-positioned following maintenance in August 2006. Post maintenance testing failed to include system flow testing. The condition was identified during subsequent system flow testing that showed less than the required amount of SW flow through the heat exchanger. The CR was categorized as an adverse condition with a RCE assigned. An operability determination had shown that the actual flow was adequate to achieve the CCW design function.

Corrective actions included resetting the valve position, revising the post-maintenance test manual to prescribe flow testing for the CCW SW outlet valves, and one-time lessons-learned training for operations and maintenance personnel.

The Team found the CR category and evaluation method acceptable. The decision to write an OE report was appropriate, and the RCE was adequate. The Team determined that the implementation of corrective actions was acceptable.

#### **CR 07-26911, Scaffold Wrench Dropped in the Transfer Canal**

This CR was categorized as an AF to document a scaffold crew dropping a wrench in the transfer canal. The wrench fell off its lanyard because the metal retaining clip inadvertently opened during use. Corrective action included standing down the crew until all similar clips were taped shut. The tool was easily retrieved. Subsequently, a less vulnerable tool lanyard clip was implemented.

The Team found the CR category and evaluation method acceptable. The decision not to write an OE report was appropriate, and the implementation of corrective actions was acceptable.

#### **CR 07-29742, NRC Concerns With CR 07-29188**

This CR was categorized as an AF to document NRC concern that the calculation demonstrating operability of the borated water storage tank (BWST) (including vortexing) as a safety injection and containment spray source used questionable non-Davis-Besse testing. CR 07-29188, Vortex Formation with ECCS suction from the BWST, concluded that a 15% air ingestion to Emergency Core Cooling System (ECCS) pumps would have no significant effect on pump performance, based on non-Davis-Besse pump testing. When the NRC questioned the basis for this conclusion, the calculation was revisited and several over-conservatism were corrected, which reduced any air ingestion to allowable values. Therefore, the non-Davis-Besse testing rationale was eliminated and no further corrective actions were required.

The Team found the CR category and evaluation method acceptable. The decision to write an OE report was appropriate, and the implementation of corrective actions was acceptable.

#### **CR 07-30458, Nonessential Inverter YVA & YVB Diode Failure Trend**

This CR was categorized as an adverse condition evaluated at the limited apparent cause level (AL) to document a trend of diode failures in the nonessential inverters. Corrective actions included the determination that the diodes have either a marginal voltage capability or a manufacturing quality defect that affects the longevity of the diodes. Because these diodes are only used in non-safety related inverters that are currently not experiencing problems, no further action was taken.

The Team found the CR category and evaluation method acceptable. The decision to write an OE report was appropriate, and the implementation of corrective actions was acceptable.

#### **CR 08-38217, Purification Demin 1-1 Exhausted Earlier Than Expected for Lithium Removal**

This CR was categorized as an AL to document the premature saturation of the reactor coolant system delithiating demineralizer. The premature exhaustion of the resin bed required an accelerated schedule to prepare a replacement demineralizer for service. The limited cause was determined to be the lack of a procedure to monitor delithiating capacity, with criteria for timely preparation of a replacement demineralizer. Corrective action included the development of such a procedure or business practice.

The Team found the CR category and evaluation method acceptable. The decision not to write an OE report was appropriate, and the implementation of corrective actions was acceptable.

**CR 08-38321, Use of Wrong RWP**

This CR was categorized as an AL to document an improper entry into a high radiation area. Miscommunication between control room and field operators and between the field operators and a radiation protection technician resulted in bypassing normal controls because an urgent condition required prompt action. No significant dose was received. Corrective actions included development of radiation protection guidance to address handling of urgent issues when an Alert or higher emergency condition has not been declared. The miscommunications were addressed through lessons-learned training for operators.

The Team found the CR category and evaluation method acceptable. The decision not to write an OE report was appropriate, and the implementation of corrective actions was acceptable.

**CR 08-37093, Variability in Reactor Coolant Cobalt-58 Measurements**

This CR was categorized as an AL to follow-up on a variation in reactor coolant sample results for Cobalt 58 (Co-58). A detailed analysis of potential causes for the variation in Co-58 results concluded that possible causes were contamination in the sample piping and collection facilities or variation in the sample purge rate established by different analysts. Corrective actions included replacement of sample collection equipment to reduce possible contamination, and modification of sample procedures to better control a common sample purge rate.

The Team found the CR category and evaluation method acceptable. The decision not to write an OE report was appropriate, and the implementation of corrective actions was acceptable.

**CR 08-32521, Pressurizer Boundary Leak Found During Decay Heat Drop Line Weld Overlay**

Refer to Section 2.2.1 for discussion.

**CR 08-33026, Broken Tubing on Train 2 CREVS Loss of Refrigerant and Compressor Trip**

Refer to Section 2.2.1 for discussion.

**CR 08-34065, While Performing DB-SC-03022 Breaker 34562 Closed and Immediately Reopened.**

Refer to Section 2.2.1 for discussion.

**CR 08-36528, Probable FW Heater Tube Leak In Train 1 High Pressure FW Heaters**

Refer to Section 2.2.1 for discussion.

**CR 08-34050, Gas Void Detected At Core Flood Tank 1-1 Discharge Pipe**

Refer to Section 2.2.2 for discussion.

**CR 08-34807, Delay In Performance Of RCP Seal Leakage Test DB-SP-03356**

Refer to Section 2.2.2 for discussion.

**CR 08-39741, Internal Flooding When Service Water Pump 1 Strainer Placed in Service**

Refer to Section 2.2.2 for discussion.

### **CR 08-36633, INPO Chemistry Assist: Improve Radiological and Safety Laboratory Practices**

Refer to Section 2.3.1 for discussion.

### **CR 07-32112, Pressurizer Level Decrease While Placing DH Train 1 in Standby**

Refer to Section 2.3.1 for discussion.

### **CR 07-21934, CNRB Action-Inconsistent DBOV CR Initiation rate compared with BVOV & PYOV**

Refer to Section 2.6.4 for discussion.

## **2.1.2 Review of SAP Non-Maintenance Notifications**

The Team reviewed selected SAP non-maintenance notifications to determine if adverse conditions have been inadvertently entered as a notification without reference to a CR.

Currently, two experienced Davis-Besse staff members are assigned to screen all non-maintenance notifications to assure they are not adverse conditions. The screeners use the adverse condition definition and supplemental guidance appearing in NOP-LP-2001. While some SAP items require additional clarification to affirm the absence of an adverse condition, the rate of finding adverse conditions in SAP has reduced to about one every 60 days. Adverse conditions identified during screening are included in the CAP.

The Team reviewed all SAP non-maintenance notifications entered on six selected days during the last six months. Nine items required additional information, and no adverse conditions that were not also tracked by a CR were identified in each of the samples. The Team concluded that the SAP screening effort was effective in preventing adverse conditions from being tracked solely in SAP. The rate of identification of adverse conditions in SAP warrants continuation of the screening effort.

The Team determined that another action tracking system, the FENOC Integrated Training System (FITS) managed by the Training staff, had the potential to contain adverse conditions. There is no regular screening of FITS; however, Davis-Besse indicated that the content of items in FITS is monitored by Training management, and reviewed during self-assessments. Although the Team reviewed selected FITS items and found no adverse conditions required to be in the CAP system, the Team concluded that FITS is vulnerable to hidden adverse conditions.

The Team found that Davis-Besse adequately managed its action tracking systems to assure adverse conditions were tracked and trended through the CAP.

## **2.1.3 Results of Interviews with Davis-Besse Nuclear Power Station Personnel**

The Team interviewed a broad cross section of site and corporate personnel from various staff and management organizations. These interviews were conducted in order to determine the staff commitment to the CAP, the extent of their knowledge and understanding of the Davis-Besse station corrective action problem identification and correction process, and their willingness to report problems. The review also included questions related to the staff view of the Davis-Besse management's response to the identified issues.

The Team did not identify any staff member who was not willing to report safety problems. There continued to be "pockets" of individuals and groups who very rarely, if at all, initiate a CR. In all of those cases, the staff member stated that he would inform his supervisor who would then write the CR.

Most individuals indicated that they thought the station was using the CR process more than in the past, but that from their perspective, the resolution for lower tier issues was not timely. They realized that there needed to be priorities but they gave some examples where they were surprised at the length of time it took to correct some deficiencies. Examples of these issues included the following issues: repair of a sink hole in the yard, a permanent bracket needed for a contamination monitor calibration gas bottle, correction of the electrical fire pump controller, and high temperatures in the main steam valve room.

The Team followed up and noted that the electrical fire pump (EFP) had to be declared inoperable during refueling outages due to the electrical power supply and pump motor controller characteristics. CR 05-00796, Electric Fire Pump ABT Response to Electrical Transients, was issued on 1/26/2005 to investigate the loss of the EFP during a bus transfer test. The final corrective action for this CR is to replace the EFP controller with a new controller that has the appropriate circuitry to momentarily stop the pump during an interruption of voltage. Engineering Work Request EWR 01-0092 has already been initiated to replace this controller; however, the site had not approved the funding to implement the design change needed for the upgraded model of controller.

Additionally, the Team followed up on the concern of high temperatures in the main steam valve room area. CR 08-38871, Main Steam Room Temperatures above 110 F, was written on 4/22/2008 to document conditions of high temperatures in the main steam room. CR 08-38871 also documents an evaluation of the design basis and operability of components in the area. The evaluation concluded that all equipment in the environmental qualification program was qualified for greater than 40 years at the elevated aging temperatures resulting from the deficient ventilation system performance over the years.

On 5/20/2008, CR 09-40622, Main Steam Line Room #2 Roof Exhaust Fan is Degraded, was written to identify the need to repair a back draft damper, the fan motor, and the fan bearings. Furthermore, CR 08-42854, DB-MC58 Open Motor Windings, documents the identification on 7/7/2008 of the need to replace the fan.

Although the Team determined that the issues discussed above were being addressed via the CAP, the site management should consider additional mechanisms to provide feedback to the employees in order to share with them the status and reasons for certain delays in corrective actions.

The Team interviewed the Davis-Besse Employee Concerns Program (ECP) coordinator on site and discussed the experience, in general, of the ECP program and the relationship with the Davis-Besse CAP and any receipt of NRC allegations. From the information reviewed, it appears that the Davis-Besse employees feel free to report problems in the CR process as well as the ECP.

#### **2.1.4 Evaluation of Davis-Besse Corrective Actions Shared with Industry**

The Team evaluated the adequacy of the Davis-Besse Nuclear Power Station's identification, classification, and categorization of 21 CRs that were assessed by plant personnel for possible feedback to the nuclear industry through the Institute of Nuclear Power Operations' (INPO's) Operating Experience Program.

Davis-Besse uses NOP-LP-2100, "Operating Experience Program," to determine if a CR requires an OE report to be generated. The procedure provides screening criteria for this purpose. Thirteen of the 21 CRs were evaluated as not needing an OE; the Team agreed with these evaluations. The Team validated the accuracy and timeliness of the eight sampled OE reports that were submitted. The OE reports are required by Section 4.8.3 of NOP-LP-2100 to be issued within 50 days of the CR's date. Six of eight OE reports reviewed met this criterion, with the average delivery date of 49 days.

Based on INPO data, the industry-wide 1-year rolling median for single unit plants is currently 20 reported events per year. Davis-Besse was close to this average for 2007 (18) and appears to be reporting at the same rate for 2008. INPO bins the events in three classes: Significant, Noteworthy, and Not Significant. A Significant event is rare, and no Davis-Besse OE has been classified Significant since 2002. Since then, about 3/4s of the Davis-Besse OE reports are classed Noteworthy and 1/4 Not Significant.

The Team found that Davis-Besse's OE screening procedure for reporting to industry is working well. OE events are being properly identified and reported by Davis-Besse and the resulting INPO OE reports are generally received by industry in a timely fashion.

### **2.1.5 Review of a Sampling of In-plant Logs to Verify Capture in the CAP**

The Team read a sample of site narrative logs for the past six months. Six occurrences were selected for further review. The Team determined that all of these issues were properly entered into the CAP when appropriate.

The Team also observed control room activities and toured the plant to verify that adverse conditions that occurred have been incorporated in CAP as necessary. The Team observed pump seal leakage and temporary leak collection equipment (catch container) facilities associated with decay heat removal (DH) pumps. There was a CR addressing the seal leakage on DH Pump 1, but no CR could be located covering the leakage on DH Pump 2. The Team peer perspective on this condition was that leakage requiring a temporary collection facility would not be tolerated for a long period. Davis-Besse wrote a CR (08-43046) on 7/11/2008 to address the seal leakage issue. CR 08-43046, COIA-CAP-2008 BACC on DH Pump 2 Not Being Tracked, has a problem statement identifying that the seal leakage had not been entered into the boric acid corrosion control (BACC) program. At the 7/14/2008 MRB, it was noted that the problem statement did not address the failure to promptly enter the adverse condition into the CAP. No action followed this concern. The Team raised this concern on 7/16/2008, and a second CR 08-43323, No CR Existed for DH Pump 2 Mechanical Seal Leakage, was written to address the timely identification in CAP.

The Team concluded that most adverse conditions have been appropriately entered into the CAP. The DH pump seal leakage indicates that further effort is needed to assure that all adverse conditions are promptly entered into the CAP.

### **2.1.6 Summary**

Davis-Besse CRs were clearly written, and their classification and categorization were in accordance with the program guidance. The initial steps of writing timely, accurate CRs were validated with the exception of the seal leakage found on DH Pump 2 that had not been entered into CAP. Interviews with Davis-Besse staff members at every level reveal strong commitment to the CAP program. The Team's review of SAP non-maintenance notifications and FITS did not reveal notifications that involve adverse conditions, not already associated with a CR. The process for reporting operational experience to the industry was a program strength. The Team identified two instances where CR classification in accordance with program guidance did not meet the Team's expectation of comprehensive evaluation of potentially serious events.

### **Areas of Strength**

Reporting of operating experience to industry was considered a Strength, with an effective program that screens events, selects those believed to be of interest to the industry, and issues reports in a timely fashion.

### **Areas in Need of Attention**

Downgrading CR 08-34786, High Vibrations on Generator Bearing 7, to a limited apparent cause evaluation (LACE) did not provide a comprehensive evaluation of this event. Specifically, NOP-LP-2001 requires a full apparent cause evaluation (FACE) for events when the consequences of recurrence are not acceptable. A FACE would have required a thorough extent of condition to be evaluated.

### **Areas for Improvement**

None

### **Conclusion**

The Team rated the *Identification, Classification, and Categorization of Conditions Adverse to Quality* as EFFECTIVE.

## **2.2 Evaluation and Resolution of Problems**

The Assessment Team performed the following analyses:

- a. Analyzed CRs using full apparent cause or root cause evaluations;
- b. Analyzed CRs using limited or full apparent cause or root cause evaluations related to human performance;
- c. Analyzed the problems selected above, determined the Davis-Besse Nuclear Power Station's effectiveness in implementing the CAP; and
- d. Identified any strengths or weaknesses to responses found during the detailed analysis above.

To address these issues, the Team reviewed approximately 19 CR evaluations, including a minimum of three RCEs and 16 ACEs. The Team reviewed these documents to determine whether (1) the analytical tools used (event and causal factor charting, failure mode analysis, change analysis, barrier analysis, task analysis, etc.) were appropriate; (2) the stand-alone document was clear and follows the procedure; and (3) whether the depth of the investigation was appropriate.

### **2.2.1 Analysis of Root and Full Apparent Cause Evaluations**

#### **CR 08-32521, Pressurizer Boundary Leak Found During Decay Heat Drop Line Weld Overlay**

During the 15th refueling outage in January 2008, while performing pre-emptive mitigation of an alloy 600/182/82 dissimilar metal weld on the 12-inch DH drop line branch connection from the reactor coolant system hot leg, the weld machine operator noticed water seeping from a small hole in the initial pass of overlay bead. The leakage was measured as less than one drop per minute with at least 23 feet of borated water covering the top of the irradiated fuel assemblies that were seated within the reactor pressure vessel. A single axial flaw less than 1.75 inches long in a nozzle-to-elbow dissimilar metal butt weld was located at the area of the leakage through the weld overlay. This CR was categorized as a SR.

Davis-Besse decided not to take a boat sample of the affected weld area, so a definitive failure mechanism was not available. The probable cause was determined to be Primary Water Stress Corrosion Cracking based upon similar characteristics with operating experience at other plants. A contributing cause was less than adequate contour of the dissimilar metal butt weld region, resulting in partial coverage ultrasonic examinations. The corrective action consisted of completing the structural weld overlay after peening and weld repair to seal the axial flaw. The weld overlay established a surface that facilitates adequate ultrasonic examination.

The extent of condition review assessed other susceptible alloy 600 material locations associated with the pressurizer or hot leg to ensure that adequate inspection or mitigation was performed. The conclusions were appropriate based on the configuration of known areas. Long-term corrective actions address repair plans for alloy 600 based on previous Davis-Besse commitments to the NRC.

The safety culture issues were not directly specified in the RCE, including the decision-making resulting in performing the weld repairs with DH in service. This issue was discussed in the Company Nuclear Review Board (CNRB) review on 7/10/2008. Based on discussions with the author, CR 08-32593 was submitted to address organizational issues with performance of the overlay repairs with DH in service. The conclusions from CR 08-32593 were that the risk of the overlay to DH service was reviewed; however, the work was considered non-intrusive and therefore would not impact the operation of the system. It was not known that the work would have the potential to induce a through-wall leak.

Corrective actions from CR 08-32593 were that project managers for any projects with the potential to impact key safety functions [DH, Rector Coolant System (RCS) Inventory Control, Power Availability, Reactivity Control, Containment Closure, and Spent Fuel Cooling] should be scheduled to meet with the Shutdown Defense in Depth Review Team (SDRRT) prior to or during the pre-outage schedule review. The purpose of the meetings is to ensure that the project managers understand the impact to defense in depth and to ensure that the SDRRT understands the scope and impact of the project.

Review of safety culture issues is currently not required by NOBP-LP-2011, "FENOC Cause Analysis." A revision is in review that includes this review for RCEs. The Team recommended making this review part of the root cause template for consistency in review.

The Team found that (1) the immediate responses to the event were effective and timely; (2) the RCE and subsequent analysis through 08-32593 were detailed and thorough, however, the actual cause was not determined because Davis-Besse failed to take a boat sample of the affected area; (3) the analysis results that included the actions required by the CARB were complete; and (4) the corrective actions were adequate.

#### **CR 08-36573, Inadvertent Addition Of Station Air Into The Condenser Causing Degraded Vacuum**

On 3/10/2008, with High Pressure Feed Water (HPFW) Train 1 isolated for repairs of tube leaks in HPFW Heater 1-5, Operations was requested to perform a leak check of HPFW Heater 1-5. The Reactor Operator was notified that Station Air was to be used on the shell of HPFW Heater 1-5. HPFW Heater 1-5 was filled with demineralized water and pressurized to approximately 70 psig with Station Air when it was noted that Condenser pressure was rising unexpectedly. Station Air was verified to be isolated and the Mechanical Vacuum Pump was automatically started to restore Condenser Vacuum to normal. During this transient Reactor Power increased from 94.6% to approximately 97.3% before reducing back to approximately 94.6% as vacuum was restored to normal. The unexpected power increase was determined to be a Level 3 Reactivity Event. This event was categorized as a SR.

Three root causes of the event were determined to be the following:

1. Less than adequate work practices by the problem solving team in that the team failed to follow the problem solving and decision making procedure correctly and did not produce a required written problem solving or troubleshooting plan.
2. Less than adequate work planning by the planning organization in that the troubleshooting work order did not contain sufficient detail to support adequate review or control of the work to be performed.
3. Less than adequate Management/Supervisory Methods in that operations personnel exhibited insufficient awareness of the impact of actions on nuclear safety or reliability during troubleshooting activities.

Engineering, planning, and operations personnel were assigned corrective actions to provide staff training for lessons learned. The training included both short-term and continuing training elements. Additionally during CARB review, additional actions were assigned to perform a case study to provide an overview of the event and its causes, emphasizing proper questioning attitude with regard to the assumptions made during the event. It was a noted strength that the CARB discussions provided additional actions to address safety culture issues.

The Team found that (1) the immediate responses to the event were effective and timely, (2) the RCE was detailed and thorough, (3) the analysis results that included the actions required by the CARB were complete, and (4) the corrective actions, to date, were adequate.

#### **CR 08-36528, Probable FW Heater Tube Leak In Train 1 High Pressure FW Heaters**

On 03/07/2008, at approximately 07:30, high pressure heater 1-5 drain flow exhibited a step increase. At approximately 09:00, that same morning, a second step increase in heater 1-5 drain flow was noted. The #1 high pressure heater string was taken out of service and isolated. Upon examination of the heater, two tubes (28-29 and 29-29) were discovered severed in the lower portion of the tube bundle.

A full apparent cause was performed and determined that the apparent cause was a service induced tube failure. Although the specific mechanism has not been identified, likely mechanisms are fatigue failure due to flow-induced vibration or circumferential cracking caused by corrosion. The FW Heater was 100% eddy current inspected during the previous RFO. The flaw was not detected during this inspection. The feedwater heater non-destructive examination (NDE) technology used for routine examinations is not optimum for the likely failure mechanisms. Although both the Electric Power Research Institute (EPRI) Feedwater Heater Maintenance Guide and Fleet template for HPFW Heaters (NORM-ER-3507) recommend eddy current as a NDE technique, neither document requires the use of the necessary specialized probes (e.g., rotating pancake).

Corrective actions included:

1. Plug the failed tubes and two rows around the tubes.
2. Develop the appropriate feedwater header tube health strategy based on industry guidance as well as internal operating experience and previous eddy current data. Based on the results of what this maintenance strategy entails, develop implementing corrective actions if required.
3. Perform an inspection of a sample of the tubes in heater 1-5 using a rotating pancake probe (or other appropriate probe sensitive to circumferential defects) at the tube sheet.

4. Initiate and schedule orders to perform hydrostatic testing of the Train 1 and Train 2 HPFW heater strings.

The plan includes short-term (hydrostatic testing) as well as longer-term actions to determine the health of the FW heaters. Based on conversations with the apparent cause author, the failed tube will not be pulled during the next RFO due to the loss of evidence; the tube failed at the tube sheet. Other tubes may be pulled based on inspections performed based on the better NDE techniques (use of pancake probe or other probe sensitive to circumferential defects). The intent would be to determine cracks or defects at the tube sheet which were missed during the previous eddy current examinations.

The Team found the CR category and evaluation method acceptable, and the decision to write an OE report was appropriate. The Team found (1) the immediate responses to the event effective and timely, (2) the FACE was detailed and thorough, (3) the analysis results that included the actions required by the CARB were acceptable, and (4) the corrective actions, to date, were adequate.

#### **CR 08-34173, CREVS Train 1 Low Refrigerant Charge**

Control room emergency ventilation (CREVS) Train 1 was found tripped on low refrigerant charge. The compressor restarted when the combination high/low refrigerant pressure switch PSHL28019 was reset. With the compressor running, excessive bubbles were observed in the liquid line sight glass indicating low refrigerant charge. Davis-Besse found refrigerant oil on the bottom of Service Water Flow Control Valve FCV5896, indicating the connection from the compressor to the valve needed tightening.

This CR was categorized as a Condition Adverse to Quality – Full Apparent Cause (AA). A FACE was performed and determined that the apparent cause of the event was inappropriate post-maintenance testing. The most likely cause of refrigerant loss was a combination of HA41 leaking by its seat while the refrigerant line was disconnected from SW5896 during 15 RFO and the leak found at the refrigerant line connection to SW5896 after the completion of the Service Water piping replacement. Post Maintenance testing for Order 200097432 only included a visual leak check for the Service Water piping that was replaced.

Corrective Actions include:

1. Inspect for and repair any leaks and add refrigerant. This item was completed under Order 200298090.
2. Revise PM 1188 and 1189 (system leak inspections) to increase the frequency from six months to three months. The increased frequency will allow early detection of any leaks or low charge. The frequency will be returned to a six-month interval once all leaks are repaired and confidence in the system is restored. DB-REV-08-0112 and DB-REV-08-0113 have been submitted. This action was considered an enhancement.
3. Revise the Post Maintenance Test Manual to include SW5896 and SW5897 in Section 2.2 Valve Table. The required post-maintenance test procedures will be DB-SS-03041 and DB-SS-03042 for Train 1 and 2 respectively. The test requirement will be a leakage verification on the refrigerant line connection to SW5896/SW5897. Notification 600446303 has been initiated.

The Team found that (1) the immediate responses to the event were effective and timely, (2) the FACE was detailed and thorough, (3) the analysis results that included the actions required by the CARB appeared complete, and (4) the corrective actions, to date, adequate.

### **CR 08-33026, Broken Tubing on Train 2 CREVS Loss of Refrigerant and Compressor Trip**

A Freon line sheared causing the Train 2 CREVS Compressor to trip. The CREVS unit was declared inoperable and appropriate actions were initiated, including suspension of Core Alterations in accordance with operating procedure DB-OP-00030. The apparent cause of the Freon line failure was metal fatigue failure due to repeated tightening of a Swagelok fitting and system vibration. It was noted that the failed components were discarded prior to causal analysis; therefore, the apparent cause was determined based on interviews with mechanical maintenance. CR 08-35887 was submitted to document the discarded failed component. The sensing line was repaired and a new Swagelok fitting was installed.

The system engineer was interviewed to discuss the extent of condition from this cause evaluation. He stated that the Train 2 CREVS compressor sensing lines were recently replaced prior to failure; therefore, corrective actions include reference to DB-MM-09027 for installation of Swagelok fittings into the procedure for performing maintenance on the compressors. The Train 1 CREVS sensing lines had not been recently replaced. CREVS was placed in Maintenance Rule a(1) status in February 2008. One of the corrective action plans is to replace the sensing lines on both compressors. The team found the extent of condition discussion to be weak because it did not specifically state why Train 1 CREVS fitting replacement was not required.

The Team found that (1) the description was clear, (2) the categorization was appropriate, and (3) the evaluation method was appropriate. Also, (4) the immediate responses to the event were effective and timely, (5) the FACE was detailed and thorough, (6) the analysis results that included the actions required by the CARB appears complete, and (7) the corrective actions were adequate for Train 2, but the documented extent of condition was weak.

### **CR 08-36684, CREVS 1 Compressor Trip During Monthly Test DB-SS-03041**

During the performance of CREVS Monthly Test DB- SS-03041, the compressor tripped after running a short period of time.

This CR was categorized as an AA. A full apparent cause was performed and determined the most likely cause of the low oil pressure trip was a combination of the low oil condition as well as leaving the normal ventilation system in service while running the CREVS monthly surveillance.

Corrective actions included adding oil to the compressor and changing the operating procedure to remove normal ventilation alignment prior to starting the compressor to allow the compressor to load. Oil was added to the compressor; however, the same event occurred during the monthly surveillance on 7/3/2008. The corrective actions for procedure changes to remove the normal ventilation alignment to allow the chiller to load were completed; however, this was not adequate to prevent recurrence of the event.

The Team found that (1) the immediate responses to the event were effective and timely; (2) the FACE was detailed; (3) the analysis results were complete, however, further analysis is required to determine the cause to ensure corrective actions prevent recurrence; (4) the corrective actions were not effective in preventing recurrence of the event as evidenced by CR 08-41525, "CREVS Has Exceeded The Maintenance Rule Reliability Performance Indicator." This is an **Area in Need of Attention**.

### **CR 08-32755, RCM 5328 CREVS Train 2 Pulley Failure**

This CR was categorized on 1/7/2008 as an AA and required a FACE. On 1/8/2008, the MRB indicated that this is not a critical component and that it had approved a downgrade to an AF if it was not a Maintenance Rule Functional Failure (MRFF). Subsequent review determined that it was a MRFF.

The cause evaluation determined that the radiation monitor low flow was caused by a failed fan pulley. The failed pulley was of a less robust original design and failed due to metal fatigue on the spot weld points on the pulley. The defective motor pulley was replaced with another safety grade stamped, welded pulley.

A good extent of condition review was performed to look at the design of other similar radiation monitors. Neither of the two monitors with similar stamped pulleys showed signs of failed welds. However, these are planned to be replaced with cast pulleys. An OE report to the industry was prepared.

The Team determined that the cause evaluation was adequate and the corrective actions were appropriate.

#### **CR 08-34065, While Performing DB-SC-03022 Breaker 34562 Closed and Immediately Reopened**

While performing DB-SC-03022, Off-Site AC Sources Bus Transfer Test, breaker 34562 was closed and immediately reopened. Numerous alarms and calls were received in the Control Room, including start up transformer (SUT) alarms. Subsequently, SUT X02 lightning arrestor failures were identified.

This CR was categorized as an AA (downgraded from an AR). The FACE was performed and concluded that the cause of the event was sustained overvoltage on the lightning arrestors. The overvoltage was caused by a Ferro-resonant condition set up during lockout of SUT X02. The most likely source of voltage for excitation of the resonant circuit was from SUT X01 through 13.8 KV Bus B.

Corrective actions yet to be completed include testing of breaker protective circuits and the installation of two new breakers in the 345 KV switchyard. Some corrective action due dates are 12/31/09 due to the complexity of upgrading and installing new circuit breakers.

An OE report was issued for this event with Notification 600439737 tracking this activity. Generic Implications included a review of a previous OE 2656 that identified that Ferro-resonance of large power transformers (as a result of power circuit breaker contact capacitance) was unusual in the industry. Although rare, a resonant case at Oconee in 1988 was identified and provided background information for the cause evaluation.

The Team determined that the identification (self-identified event), classification, and categorization were appropriate. The ACE was detailed and thorough, and justified with a comprehensive analysis. The corrective actions have not yet been completed.

#### **CR 34408, RCP 2-1 Motor Mechanical Damage During Start**

On 1/28/2008, during startup of Reactor Coolant Pump (RCP) 2-1, the motor cover was damaged as a result of a tool being left in the motor after maintenance. Shortly after starting the pump, a local operator notified the Control Room that the motor cover was being impacted by a rotating element and the resulting friction caused the paint on the cover to ignite. The pump was immediately shutdown.

A full apparent cause was performed for this event. The apparent cause of the event was determined to be insufficient supervision and procedure noncompliance in that an employee signed a procedure step stating that the tool was removed and he had not verified or removed the tool.

Corrective actions were:

1. Individual performance issues associated with this event were addressed in accordance with the FENOC Performance Management program.

2. A site-wide NEWS release was distributed on 1/28/2008 regarding the damage to Reactor Coolant Pump Motor 2-1. This email was distributed to document a substantial "near miss" that the site can learn from to prevent significant events in the future.
3. A Mechanical Maintenance Stand-down was performed on 1/28/2008.
4. The RCP hand rotation tool left in RCP 2-1 was removed.

The Team found that (1) the immediate responses to the event were effective and timely, (2) the FACE was detailed and thorough, (3) the analysis results that included the actions required by the CARB appeared complete, and (4) the corrective actions were adequate.

#### **CR 07-19158, Caldon System Trouble Alarm 10-4-A**

This CR identified, on 4/24/2008, an unexpected LEFM trouble alarm. The operators took the system out of service, using the feed water venturi until repaired. This was the "major" CR which tracked the Cameron, lab tests and RCE, and the final OE report to industry.

The newly modified transducers were replaced into meter #2 in November 2007 and Davis-Besse properly decided to observe performance before replacing the meter #1 transducers. Train 1 was replaced in April 2008 and has been observed to be operating reliably since then.

The final OE report to industry was issued in December 2007 upon receipt and review of the Cameron RCE.

The Team identified that the CR was categorized properly, that the ACE was thorough and used the expertise of the vendor, and that the corrective actions were timely and appropriate. In addition, since the vendor implemented and Davis-Besse installed the modified transducers, there have not been any more distraction alarms for the control room operators.

#### **CR 08-37319, Electrical Near Miss While Installing Fence Post**

Refer to Chapter 2.1.1 for discussion.

### **2.2.2 Analysis of Condition Reports Related to Human Performance**

#### **CR 08-34050, Gas Void Detected At Core Flood (CF) Tank 1-1 Discharge Pipe**

On 1/22/2008, during the 15 RFO outage, preventive maintenance (PM) was performed to test a core flood tank (CFT) outlet isolation valve. This emptied the CF Tank 1-1, which was pressurized at the time, causing voiding of the discharge piping. Operations requested an ultrasonic void test (UTV) of the CF Tank 1-1 discharge piping. The UTV determined that the discharge piping was void of water up to the elbow downstream of the outlet isolation valve. The possibility that the RCS piping was also affected led to both an Operations Evolution Order (OEO) written to purge the CFT injection line of gas, as well as RCS venting in accordance with DB-OP-06000, Filling and Venting the Reactor Coolant System, Sections 3.8 and 4.7. These actions were completed on 1/24/2008. This event occurred while the core flood system was in a state of maintenance and was not a reportable event.

This CR was classified as an AL. A LACE was performed. The evaluation determined that the most likely cause of voiding in CFT 1-1 discharge piping was performance of valve stroke CF1B with CFT pressure at 70 psig. The pressure differential between the CFT and RCS was too high to preclude voiding the discharge piping when stroking CF1B. The most likely cause for this to occur is failure of on-shift

supervision to fully understand how the change in plant conditions would impact the work associated with CF1B. The apparent cause was therefore determined to be that control room operators had multiple duties and did not properly monitor the CFT level and pressure during the CF1B stroke for PM completion.

Corrective actions included development of an OEO "procedure" to vent the piping. Additionally, the Shift Engineer and Unit Supervisor were coached on ensuring they understood plant conditions and the impact on plant activities prior to allowing those tasks to continue. Additionally, training was performed during operations licensing requalification to discuss lessons learned from the event.

The Team found the CR category and evaluation method acceptable. The decision not to write an OE report was appropriate, and the LACE was adequate. The Team determined that the evaluation was sound, and the implementation of corrective actions was acceptable. However, the corrective actions for the human performance issues that initiated this event were weak. The one-time corrective actions do not appear to provide long-term barriers to avoid recurrence. Normally, industry operating experience has shown that human errors are remediated by programmatic barriers, such as procedure changes to prevent the conditions leading to an abnormal event. No such barriers were proposed (e.g., surveillance procedure change to specifically address testing with a pressurized CFT). NOP-LP-2001 addresses this concept through the use of a Safety Precedence Sequence (SPS) when developing corrective actions. The choices range from a modification to preclude the event to acceptance of recurrence with no corrective actions. In this case, Davis-Besse concluded that the training provided satisfied the awareness level of the SPS (just above the no action level). The Team determined that action at least at the procedures level would have been appropriate. This is an **Area in Need of Attention**. Two other examples of this problem are detailed in CR 08-39741, below, and Section 2.3.1 (07-32112) of this report.

#### **CR 08-39741, Internal Flooding When Service Water Pump 1 Strainer Placed in Service**

On 5/4/2008, there was an internal flooding event in the service water (SW) pump room. Maintenance on cooling tower makeup pump and strainer piping required a tag clearance to isolate the piping from the combined discharge header for SW and Cooling Tower Make-up (CTMU) strainers. The clearance was implemented on 4/28/2008 and included tagging valve CT924 closed to isolate from the combined discharge header. Subsequently, piping in the SW pump room was disassembled. On 5/4/2008, when SW strainer #1 was placed in service, water sprayed out of the open piping into the SW pump room. Operators implemented the internal flooding procedure and stopped the flooding by manually closing CT924.

This CR was categorized as an adverse condition and assigned a FACE to address a tagging/configuration problem that resulted in spraying water into the service water pump room. This room contains equipment that if lost to flooding, would compromise the service water safety function. In this case the water spray volume was able to be detected and controlled by the operators without damage to SW components in the area. The FACE determined that CT924 (a motor operated valve with no position indication) had a history of blowing its thermal overloads while stroking. There was a low priority setpoint change due in 2009 to address the overload problem. There was no maintenance deficiency tag (MDT) on the valve reflecting this condition. The clearance was improperly implemented because the operators failed to verify that CT924 was actually closed when it was tagged. The apparent cause was the valve failure and the contributing cause was the tagging error. Corrective actions included placing a MDT on CT924, placing the setpoint change in the CAP for action, remediating the operators who did not adequately verify CT924 valve position, and conducting a stand-down for lessons-learned training for all on-shift personnel.

The Team found that the apparent and contributing causes appeared to be reversed. Since the system was tagged for maintenance, the event would have been precluded if the clearance had been accurately implemented. The Team felt this should be the apparent cause. In addition, the corrective actions for the

human performance errors were short-term responses with respect to the clearance tagging program, with no long-term follow-up actions. Davis-Besse considered this action at the awareness SPS level acceptable for the human errors, and considered the setpoint change a modification SPS level action. However, the planned modification had existed since 2005 and was not scheduled for completion until 2009. The Team determined that the awareness SPS level was not sufficient for the human errors. For instance, the clearance process for motor-operated valves with no position indication may need to be strengthened. Also, similar action above the awareness level training was needed to justify the delayed implementation of the setpoint change. Other examples of this **Area in Need of Attention** are detailed above (08-34050) and in Section 2.3.1 (07-32112) below.

#### **CR 07-32112, Pressurizer Level Decrease While Placing DH Train 1 in Standby**

Refer to Section 2.3.1 for discussion of third example of weak human performance actions.

#### **CR 08-33642, DB-PA-08-01: Adverse Trend of AREVA Performance**

Six events had been identified between 1/8/2008 and 1/15/2008 that indicate a trend involving contractor (AREVA) failures to follow procedure that could point to an organizational weakness with AREVA or FENOC oversight of AREVA. This CR was categorized as an AA.

The apparent cause in all of the listed CR's included various types of human performance errors. Although all of the subject events were associated with activities under the FENOC Site Projects contract and the result of human error, the responsible group and type of error was not the same in all instances. The evaluation performed was a common cause evaluation. The results did not determine any common cause for the events reviewed.

The Team found that (1) the immediate responses to the event were effective and timely, (2) the FACE was detailed and thorough, (3) the analysis results that included the actions required by the CARB appeared complete, and (4) the corrective actions, to date, were adequate.

#### **CR 08-34513, Flood Barrier - SW Pump Valve Room #2**

A watertight door (flood barrier door 217) was found standing open by a security officer on patrol.

A LACE was performed and determined the apparent cause of the event was the door was inadvertently left open by interns working in the plant. A history of other watertight doors was reviewed and repeat issues were not identified. The noted interns secunded to Operations at the time of the incident had expectations re-enforced to them by the Operations Superintendent.

The Team found that (1) the immediate responses to the event were effective and timely, (2) the LACE was adequate, (3) the analysis results were complete, and (4) the corrective actions were adequate.

#### **CR 08-34807, Delay In Performance of RCP Seal Leakage Test DB-SP-03356**

On 2/1/2008 while reviewing the Surveillance Test Alert Report (STAR) during plant startup from RFO15, it was discovered that test DB-SP-03356, RCP seal leakage had not been performed as required before it's TS late date. TS 4.0.3 was entered until the test was successfully completed. A LACE was conducted, the Operations Section clock was reset, and the causes of the oversight discussed by the Operations Shift Superintendent at a Shift Managers meeting.

The LACE indicated that the cause of the error was the assigned Senior Reactor Operator (SRO) misread the STAR report. The Team reviewed this assertion with the cause evaluator to determine whether any process issues, such as the need to improve the STAR, was pursued. The evaluator indicated he was

satisfied that the STAR report was clearly written per interviews with a number of SROs, and so a process issue was not judged to be a contributing cause and was not pursued.

The Team found that (1) the description was clear, (2) the categorization was appropriate, (3) the evaluation method was appropriate, and (4) the cause evaluation was determined to be adequate.

#### **CR 08-35909, SAC Approval Not Obtained Prior to RWP 2008-5601 Dose Estimate Being Increased**

This CR identified, during an ALARA post-job review, that the DH suction line weld overlay dose estimate had been increased from 3893 mrem to 8013 mrem without the Station ALARA Committee (SAC) approval. The procedure, NOP-WM-7002, required the SAC to approve any outage task above 5000 mrem. The CR documents that the “mindset” was that the dose could be added provided the total dose for the Alloy 600 mitigation work stayed below the budget of 32.1 Rem.

This was categorized as an AL and a review for possible site clock reset was requested. The apparent cause was determined to be that the SAC had approved this dose adjustment, but that the SAC meeting minutes for 1/10/2008 were incomplete. The note taker was not available on the 1/10/2008 meeting, and a corrective action was taken to revise the SAC meeting minutes.

The Team found that (1) the description was clear, (2) the categorization was appropriate, (3) the evaluation method was appropriate and (4) the cause evaluation and corrective actions were adequate.

#### **CR 08-36633, INPO Chemistry Assist: Improve Radiological and Safety Laboratory Practices**

Refer to Section 2.3.1 for discussion.

### **2.2.3 Summary**

The Team determined that Davis-Besse demonstrated a very good understanding of evaluation and problem resolution methodologies. However, cause evaluation guidelines do not include explicit safety culture attributes for evaluation. Good evaluations were noted on feedwater heater tube problems and the leading edge flow meter issues. The cause of pipe cracking in alloy 600 materials was not definitively determined because a boat sample was not taken of the affected area. The cause evaluation and corrective actions for recurrent tripping of the CREVS compressor were not effective in preventing a subsequent failure. There were three examples where the cause evaluation and corrective action for human performance issues was weak because the corrective actions were not implemented at a sufficiently high safety precedence to assure effective long-term remediation.

#### **Areas of Strength**

The corrective actions for the LEFM distraction were considered an *Area of Strength*.

#### **Areas in Need of Attention**

1. CREVS compressor trips have not been resolved. Specifically, CR 08-36684, CREVS 1 Compressor Trip During Monthly Test DB-SS-03041, cause evaluation did not determine corrective actions which would prevent recurrence of the event.
2. There were three instances where the cause evaluation and corrective actions for human errors was weak because the corrective actions were not implemented at a sufficiently high safety precedence to assure effective long-term prevention. Corrective actions for human errors were limited to short-term training sessions. These events included CR 08-34050, Gas Void Caused by

CFT 1-1 Discharge; CR08-39741, Internal Flooding in the SW Pump Room; and CR 07-32112, DH System Voiding Due to Ineffective Fill and Vent after Maintenance.

### **Areas for Improvement**

None

### **Conclusion**

The Team rated the *Evaluation and Resolution of Problems* as EFFECTIVE.

## **2.3 Corrective Action Implementation & Effectiveness**

The Team performed an analysis of the implementation and effectiveness of corrective actions for CAQs. The analysis consisted of:

- a. Evaluation of the timeliness and effectiveness of corrective actions;
- b. Review of the number of repeat CRs and corrective actions and evaluate the effectiveness of corrective actions;
- c. Evaluation of the adequacy of the Davis-Besse Nuclear Power Station's implementation of corrective actions for operational experience feedback from the industry; and
- d. Review of the activities of the CARB and evaluate the effectiveness of the CARB.

### **2.3.1 Timeliness and Effectiveness of Corrective Actions**

#### **CR 08-36633, INPO Chemistry Assist: Improve Radiological and Safety Laboratory Practices**

During an assist visit, Chemistry laboratory observations identified several occurrences of less-than-adequate radiological and personnel safety practices and controls. These included work in and around radiation protection (RP) boundaries, control of potentially contaminated samples, use and storage of syringes, and storage of gas cylinders. This CR was categorized as an AL. The evaluation concluded that the apparent cause was the failure to follow written documentation in that written standards, as conveyed by RP procedures and the Chemical Hygiene Plan (CHP), were not adhered to. In the case of the challenges to RP practices, behaviors were found to be in accordance with long-standing practices. Challenges to boundary and contamination controls may have been recognized, but no action was taken to correct them. With regard to laboratory safety practices, it appears that the programmatic guidance of the CHP was not known, and certainly not adhered to. The Plan does provide detailed criteria that, if followed, would have precluded many of the observed items and behaviors.

The evaluation also found a contributing cause: a diminished field presence by Chemistry Management personnel in the laboratories. CRs 08-36454, 08-36045, and 08-36634 all discuss the impact of infrequent management oversight in housekeeping and personnel performance issues.

The Team determined that the CR provided no corrective actions concerning the management personnel in the laboratories. In addition, no actions were developed for improving human performance concerning personnel not adhering to or being aware of procedure requirements, or for increasing the frequency of management presence in the laboratories.

Discussion with the Chemistry Manager revealed corrective actions taken to address the human performance aspects of the apparent and contributing causes had been included in a response letter in the form of an Action Plan. Agreement was reached that this Action Plan and further details should have been included in the original CR 08-36633 to address the procedure non-adherence and lack of management presence in the laboratory causes identified in the CR evaluation.

The team determined that the apparent cause was reasonable. The condition was properly identified, including appropriate categorization and classification. Corrective actions were timely and effective in correcting the physical, unsatisfactory labeling and radiation boundaries in the laboratory, but were lacking in regards to having no mention of corrective actions to address the identified human performance-related cause of personnel not adhering to or being aware of procedure requirements, and did not include any corrective action for the contributing cause of reduced management presence in the laboratories. This is an **Area in Need of Attention**.

#### **CR 07-16723, Multiple Failures of AISH6571, WGST H2 Monitor**

This CR was written to highlight multiple failures of the Waste Gas Storage Tank (WGST) H2 monitors caused by excessive moisture reaching the gas analyzer. The CR was assigned an adverse condition—LACE. These monitors are TS-required instrumentation that require compensatory actions and repairs. The LACE found that the proposed solution (adding external sample line coolers to the sample piping to remove more moisture) has not received a high enough value rating to merit implementation. Given that the cost of the modification to add coolers is less than the cost of replacing the failed gas sensors, the decision to defer the modification needed to be revisited. CARB review of this CR required a CA 2 to pursue the modification. That action was subsequently closed to the SAP action tracking system.

The Team identified that the SAP item should not be tracking a closed CAP corrective action. NOP-LP-2001, "Corrective Action Program," only allows tracking corrective actions in SAP for low priority work orders. Davis-Besse recognized this error and initiated CR 08-43317, CA 07-16723-02 Closed to Notification, to resolve this issue. The Team observed that multiple CRs have been written on the WGST sample moisture problem and that trending has raised the attention focused on the issue. However, as discussed in Section 2.1.3 above, this is another example of deferral of low priority work that may undermine the staff's confidence in the ability of CAP to solve existing problems.

#### **CR 07-32112, Pressurizer Level Decrease While Placing DH Train 1 in Standby**

On 12/30/2007, while aligning the DH system to continue plant cooldown to cold shutdown conditions, a rapid decrease in pressurizer level occurred. A void in the DH piping was suspected and subsequent venting confirmed a large void existed in the DH system discharge piping. Ineffective venting after maintenance performed on the system in November 2007 caused the void. This event was categorized as a significant condition and assigned a RCE.

The RCE concluded that procedure DB-OP-0612, Decay Heat Removal System, and the Operations Evolution Order (OEO), used to augment the procedure for system fill and vent in November 2007 provided inadequate guidance to properly complete this evolution. In addition, another surveillance procedure (DB-SP-03212) used to verify adequate system venting lacked the relevant guidance to assure DH system discharge piping was full. Contributing causes included weaknesses in the procedure review process that failed to identify the procedure omissions, and work control inadequacies and communications that did not identify the problem during the planning process.

Corrective actions included revisions to the DB-OP-0612 and DB-SP-03212, one-time training for the operations and system engineering organizations, and a series of actions to investigate the extent of cause to other safety systems. The investigations were due six months after the event, when three other system

procedures were found deficient and new CRs were written at the AF level to correct the deficiencies. Due dates for two of these issues extended the condition for three or four months. Davis-Besse considered the lack of planned outages for these systems and the staff's sensitivity to voiding issues immediately following the event and the subsequent training sessions adequate to justify extending the due date for extent of cause resolution to several months following the event.

On 2/18/2008, CARB reviewed this RCE making significant improvements including, human performance clock reset evaluations, addition of a corrective action to address the procedure DB-SP-03212 deficiency, alignment of corrective action due dates with planned system outages, and improved due dates for the lessons-learned training. These corrections were completed by 2/25/2008.

The Team was concerned with the length of time over which the extent of cause review and correction was performed. CARB had a similar focus at the 7/7/2008 meeting where another corrective action was written to reassess the impact of the collective evaluations on the original RCE findings. Davis-Besse relied on the organization's collective sensitivity to fill and vent operations to avoid recurrence in the near term before the corrective actions for extent of cause could be completed. While the Team considered more formal measures such as Standing or Night Orders a more effective tool to avoid recurrence, discussions with selected plant staff members found their familiarity and process expectations adequate, provided that the current corrective action due dates are achieved.

Similarly, the Team was concerned that Davis-Besse's ability to create temporary procedures using the OEO process could be used to bypass the normal procedure approval process. The Team confirmed the OEO process requires two SRO approvals as well as a review to determine 10 CFR 50.59 applicability. CR 07-32112 did not require actions to strengthen the OEO process particularly when used for system filling and venting evolutions not covered by approved procedures. At a 7/11/2008 CNRB meeting, the same concern was discussed. Davis-Besse is responding to this concern through the CNRB action item process.

The Team found that the event was properly categorized and the evaluation method was appropriate. After correction by CARB, the evaluation was thorough and the corrective actions were generally adequate. The Team found that the corrective action for the human performance aspects of this event focused on a single lessons-learned training session (awareness SPS level). While the procedure changes for the DH system were prompt, many of the extent of condition procedure changes were delayed, and makeup system venting relied solely on the use of an OEO. This called for other interim or process barriers to provide effective long term action. In particular, barriers are needed to assure that future OEOs for system venting take into account the causes and corrective action from this event. This is another example of the Area in Need of Attention detailed in Section 2.2.2 (08-39741 and 08-34050), above.

### **2.3.2 Review of Repeat Condition Reports**

The Condition Report Evaluation and Status Tracking (CREST) program has specific cause codes and search capabilities which can identify repeat adverse conditions. The Team identified 21 CRs since the last CAP Assessment that involved repeat conditions. The team reviewed these CRs to determine if the analyses and corrective actions were appropriate. The following is a summary of the 6 CRs involving safety systems:

- **CR 07-30257, Corrective Action to Torque on Packing for HP31 Resulted in Same Value**

This involved three maintenance orders attempting to stop a packing leak of this valve. The last order used a new packing at a low torque to allow proper operation of the valve. The leak was stopped.

- **CR 08-33974, Valve Testing of MU38 Per DB-PF-03386**

This reactor coolant pump seal return isolation valve (air actuated) was diagnosed as having an actuator air leak after the actuator was rebuilt and re-installed five days before. All accessible leak paths indicated no leakage; it was determined that leak was at the actuator bushing. A new CR (08-33558) followed the actuator re-build and its reinstallation and successful test.

- **CR 08-34323, Oil Leakage from Main Feed Pump #1 Speed Increaser**

The seal method was found defective, a new method was successful, and the procedure was modified.

- **CR 08-35250, Infrared Inspections Have Identified Repetitive Concerns Noted with BE6103**

The stab of a pressurizer heater breaker was showing a rise in temperature. The stab assembly was replaced.

- **CR 08-37825, #4Circ Pump Cooler Flow Low**

The pump's thrust bearing cooler was showing low flow. An equipment change request was submitted to add strainers to the system. The request is awaiting action.

Most of the adverse conditions reviewed were corrected by either rework or replacement actions. The Team concluded that the classification, analysis, and actions performed to address the repeat events were appropriate. No major root-cause generic issues of a repeat nature were found.

### **2.3.3 Review of the Activities of the Corrective Action Review Board (CARB)**

#### **Corrective Action Review Board (CARB) Meeting on July 7, 2008**

The Team observed the CARB meeting discussions held in the plant PSF Conference Room on 7/7/2008. The CARB conducted its activities in accordance with NOP-LP-2001 and NOBP-LP-2008 and first verified that quorum requirements were met. Agenda items included review of the following:

- Effectiveness Review of CR 05-05278, Fuel Integrity Monitoring Did Not Identify Cycle 14 Fuel Defects;
- Effectiveness Review of CR 06-8128, FAC Program Deficiency Evaluation;
- Limited apparent cause evaluation of CR 08-40879, Drop in CREVS Suction Pressure; and
- Limited apparent cause evaluation of CR 08-40906, Pipe Support Failure Due to Vibration.

The Extent of Condition review for 07-32112 involved reviewing several fluid systems to assess whether the operating procedure was adequate to prevent operation with gas intrusion into the piping. If procedures needed to be revised, a new CR was to be written for each system. The Containment Spray System procedure was determined to be acceptable, but the DH/low pressure injection system Operating Procedure was unacceptable; CR 08-40150 was written to document those concerns. The high pressure injection (HPI) system Operating Procedure was unacceptable; and CR 08-36881 was generated. The motor driven feed pump procedure was unacceptable; and CR 08-37644 was written accordingly. The Auxiliary Feed Water System procedure was sufficient, and CR 08-37644 was applicable. Although the Makeup System procedure was determined to be complex, there is no comprehensive guidance in the

operating procedure for system fill/vent, and OEOs are used instead, along with isometric drawings and Plant Engineering staff. The Team understood that placing portions of the system in service may need to be supported by special OEOs, but questioned the equivalency of OEOs to substitute for the lack of a fill and vent portion of the normal system operating procedure.

The CARB rejected the LACE for CR 08-40906 due to several comments and questions. The presenter indicated that there may be an original design problem since the vibration had gotten worse since 1994 when a modification was installed and the component failed in 2006. In 2008, it failed again and the CARB recommended that a new plan be structured to determine the cause of the problem.

The Team also noted that the CARB had several comments on the other CR Effectiveness Reviews and Extent of Condition reviews listed above. These frequently involved adding corrective actions and or revising the reviews and evaluations to include some aspect that was not included or was not clear. The Board approved all of those to be revised to include the Board comments with follow up with the Board Chairman. The CARB Coordinator indicated that he prepares the closeout information and then meets with the CARB Chairman to go over the closeout material.

#### **Corrective Action Review Board (CARB) Meeting on July 14, 2008**

The Team observed the CARB meeting discussions held on 7/14/2008. The CARB conducted its activities in accordance with NOP-LP-2001 and NOBP-LP-2008 and first verified that quorum requirements were met. Agenda items included review of the following:

- Limited apparent cause evaluations of CRs 08-37292, Recent Trend in Human Performance Not Meeting Expectations; CR 08-41216, SAC 2 Tripped; and 08-39704, RE4597BB Tripped on Overload.
- Two items were tabled due to personnel unavailability.

The CARB rejected the LACE for CR 08-37292. There were several concerns with corrective action alignment to causes and corrective action timeliness. Also the actions were not specific enough for effective implementation.

The other two CR evaluations were approved.

The Team noted thorough preparation by the members and critical discussions regarding the evaluation details and programmatic compliance. The concerns identified by the Team's pre-review of these CRs' were discussed at the CARB, particularly the specificity and timeliness of corrective actions for CR 08-37292. The Team concluded that the CARB provided effective oversight of these CRs.

#### **Review of CARB Meeting Minutes of 12/17/2007, 2/11/2008, and 2/18/2008**

The Team reviewed the minutes of CARB meetings to assess whether the documentation for these meetings was effective in implementation of NOP-LP-2001. Minutes for CARB meetings for 12/17/2007, 2/11/2008, and 2/18/2008 were reviewed. These CARB meetings typically covered items such as effectiveness reviews, cause evaluations, and selected corrective actions and CR closeouts.

The Team noted that frequently, the CARB would accept the material presented for its approval with comments noted. Additionally, the minutes indicated that it was approved that the completion of the commented actions could be closed out with verification by the CARB Chairman. As an example, during the 12/17/2007 meeting, the CARB accepted, with comments, the LACE for CR 07-29388, with the resolution of comments to be brought back to the CARB Chairman to determine satisfactory completion

of actions. The actions included (1) add an extent of condition review, (2) add a corrective action to reinforce use of design inputs in calculations with new engineers, and (3) add a corrective action if there is no additional training to bring back to the CARB. The Team questioned whether or not this LACE should have been simply rejected for the reasons given and re-done. To add a corrective action for new engineers to reinforce use of design inputs in calculations appeared to be a fundamental issue.

#### **Review of CARB Meeting Minutes of 9/24/2007, 10/8/2007, and 11/5/2007**

The Team reviewed the minutes of CARB meetings to assess whether the documentation for these meetings was effective in implementation of NOP-LP-2001. Minutes for CARB meetings for 9/24/2007, 10/8/2007, and 11/5/2007 were reviewed. These CARB meetings typically covered items such as effectiveness reviews, cause evaluations, and selected corrective actions and CR closeouts.

The Team noted that the CARB quorum requirements were met and the minutes presented meaningful discussion and comments for resolution. As stated above, the decision to table, reject, or accept with significant comments appears to be very tolerant. For instance, the FACE for CR 07-24664, SAC 1 Failed to Load, had extent of condition omissions and lacked a corrective action to follow-up the component failure analysis which was needed to establish the actual cause of the event. The FACE was accepted with comments. The opportunity for organizational learning from CARB required corrections may be enhanced by a lower threshold for CARB rejections.

#### **Review of CARB Meeting Minutes for November 12, 2007**

At this meeting, two effectiveness reviews were accepted with comments, a RCE was accepted with comments, a FACE was rejected; and a LACE was accepted with comments.

The effectiveness review of CR 06-00207, Wrong Load Value Used in Calculation Addendum (categorized as AR), concluded that the revisions in the Job Familiarization Guidelines (JFBs) as a result of the corrective actions did not result in the desired effect. CR 07-29388, Additional Actions from Effectiveness Review of CR 06-00207 (categorized as AL) was written to determine what corrective actions were needed to correct this deficiency. The CARB accepted the CR with comments. It required that another effectiveness review be conducted to determine the effectiveness of the corrected JFBs. In addition, the CARB questioned the CRs categorization as follows: NOBP-LP-2007 requires that if corrective actions are determined to be ineffective that were designated to prevent recurrence from a RCE, then the new CR should be categorized at least as the same level of the original CR. The CARB determined an AL was appropriate given the cause was not being challenged.

The Team reviewed the CARB's actions in the above case. Its review of the additional actions required by CR 07-29388 were thorough, the usefulness of effectiveness reviews demonstrated, and the CARB's questioning of the appropriateness of the AL categorization was found to be sufficiently critical.

#### **Review of CARB Meeting Minutes for March 3, 2008**

At this meeting, two LACEs were accepted with minor editorial changes, one LACE was accepted with a comment on assuring a corrective action is properly tracked, two LACEs were tabled until component analyses have been completed, one LACE was accepted with the addition of two additional CRs being written concerning related issues, and a fix evaluation was accepted with several actions requiring completion before full closure.

The Team considered the CARB review critical and challenging; the CRs with outstanding CARB actions were viewed by the Team and it was determined the responses to these actions were adequate and have been completed.

## **Other Observations of CARB Activities**

Two other Team observations of positive CARB contributions are detailed in Sections 2.1.1 (08-37319 and 2.2.1 (08-36573).

### **2.3.4 Evaluation of Operational Experience Feedback**

#### **Review of Davis-Besse Response to Incoming Operating Experience**

The Team reviewed the Davis-Besse Response to incoming operating experience in order to assess the effectiveness in implementation of the governing program procedure, NOP-LP-2100, Rev. 2.

The Team selected several OE items at random, including NRC Information Notices, INPO incoming documents, Industry Technical Reports, and OE reports for other operating power plants. In addition, the Team reviewed the internal Davis-Besse sharing and feedback of OE information to the site workers and management staff for lessons learned.

The following items were selected for review:

- NRC Information Notice 2007-39, Control of Sensitive software Categorized as Sensitive Unclassified Non-safeguards Information
- NRC Information Notice 2008-02, Findings Identified During Component Design Basis Inspections
- NRC Information Notice 2008-04, Counterfeit Parts Supplied to Nuclear Power Plants
- SEN 272, Underground Cable Ground Fault Causes Forced Shutdown
- SEN 273, Large Unplanned Exposure of a Fuel-Handling Operator
- Significant Operational Event Report (SOER) 03-2, Managing core Design Changes
- Topical Report TR8-61, Events That Involve Compression Fittings and Tubing
- Topical Report TR8-62, Cooling Tower Structure Events
- OE 26075, Activated Cobalt Alloy Pieces Found on Core Support Plate
- OE 26207, AFW Pump Mechanical Over speed Trip Mechanism Spurious Activation

The Team determined that in general, the Davis-Besse OE initial evaluations were reviewed in accordance with the Davis-Besse program; however, several seemed to take a significant time to get into the program review cycle. Certain items were handled by the site and others by the Fleet lead for the subject. The Team also noted that the OE coordinator maintains a tracking system to monitor timely response of the station lead for any necessary actions. Overdue items are followed and noted. Assignments are made via SAP notification numbers with a unique due date established. Although several of the selected items had been received several months earlier in 2008, the evaluation had not been completed yet.

As an example, SOER 03-2 was reviewed on 7/22/2003 and a Davis-Besse CR was issued to initiate a corporate evaluation of the OE and take appropriate actions. The corporate evaluation was then provided to each site. Davis-Besse took further on-site actions in the Chemistry procedures and training as well as Davis-Besse site and corporate procedure changes regarding items such as vendor audits and control of fuel design changes. Corrective actions were completed at the end of 2005.

The Team also reviewed the May 2008 Operating Experience Status Report for Davis-Besse required by Section 4.9.2 of NOP-LP-2100. One assignment was highlighted as overdue. The age of the open incoming OE reports ranged from 92 days for Information Notice IN 2007-28, to 4 days for SOER 01-01, with the average open age of 36 days. Additionally, the timeliness of posting OEs to the industry network was an average of 41 days compared to a criteria of 50 days. This May report provided a good summary of the timeliness performance and the volume of incoming and completed reviews.

### **2.3.5 Summary**

The Team determined that, in general, Davis-Besse adequately identifies the causes of adverse conditions and successfully carries out corrective actions. No major corrective action repeats were identified. The CARB is effective in assuring the quality of CRs and assures important corrective actions are completed. The opportunity for organizational learning from CARB-required corrective actions may be enhanced by a lower threshold for CARB rejections.

#### **Areas of Strength**

None

#### **Areas in Need of Attention**

CR 08-36633, concerning chemical laboratory practices, must include corrective actions to address the human performance-related cause of personnel not adhering to or being aware of procedural requirements and the contributing cause of reduced management oversight in the workplace.

#### **Areas for Improvement**

None

#### **Conclusion**

The Team rated the *Corrective Action Implementation & Effectiveness* as EFFECTIVE.

## **2.4 Trending Program Implementation and Effectiveness**

The Team assessed the implementation of the Davis-Besse existing trending programs, which include:

- Integrated Performance Assessment (IPA) trending:
  - Performance trending,
  - Cognitive trending;
- Plant Health Reports;
- Component Health & Trending Process;
- Monthly Performance Reports;
- Human Performance trending; and

- Corrective Action Program Indicators.

#### **2.4.1 Assessment of the Integrated Performance Assessment/Trending Process**

This process integrates the data and insights from over a dozen performance improvement processes. It incorporates aspects of human, organizational, and program performance indicators. Nuclear operating business practice, NOBP-LP-2018, "Integrated Performance Assessment/Trending," guides this process. A six-month cycle is generally used starting with station Sections generating cognitive trend reports for the first three months of the cycle.

The Team reviewed a selection of the cognitive trend reports (12) and found them to be penetrating analyses of each Section's issues. The major focus of these reports is an analysis of the CRs, concerning operations during the reporting period to find and adverse trends requiring added attention. If a negative trend was noted, a CR was written. The status of past CRs was then discussed, indicating the progress or its lack on corrective actions.

The second three months of the cycle are reviewed in a similar way, a Collegial Review meeting is held reviewing the entire six months, resulting in a semi-annual site roll-up Integrated Performance Assessment report. This report covers such areas as:

- Preparatory planning for major work efforts such as outages;
- Section performance ratings;
- Plant status;
- Worker safety experience;
- Human performance;
- Negative and emerging trends;
- Areas needing improvement; and
- Status of previously identified corrective actions.

The Team reviewed the two 2007 IPA reports and found that they report station status in a concise fashion with weaknesses discussed, corrective actions identified, and the status of past identified actions reported. One trending technique used in these reports involved a binning process where root causes associated with adverse conditions were binned into symptom groupings that allow the discovery of issues that stand out as problems that can be pursued and acted upon. About 40 such binning categories have been identified. Four of these categories are showing high counts requiring analysis or action by Davis-Besse, these are:

- Procedure non-compliance;
- Equipment Degradation;
- Self-Checking Inadequate; and
- Inattention to job/detail.

CRs have been written to analyze these trends and determine if corrective actions are needed.

The Team's review of the overall results of the IPA process, the strong management involvement, the efficiency in collecting and analyzing the trend data, and the identification and correction of emerging issues, show the process to be highly effective. The Team found that this process is an **Area of Strength**.

#### **2.4.2 Assessment of Plant Health Reports**

These quarterly reports provided concise summaries of the material conditions of important plant systems. They make plant staff and management aware of plant health by identifying the system's Maintenance Rule status, equipment issues, and long-term plans. Nuclear operating business practice, NOBP-ER-3009, "FENCO Plant Health Report Program," guided the development of these reports.

The Team reviewed the Davis-Besse Plant Health Reports for 4<sup>th</sup> Quarter 2007 and 1<sup>st</sup> Quarter 2008. They contained the ratings for the various Plant Systems and the present Maintenance Rule (MR) classification as well. The report contains a color-coding scheme that categorizes system health for quick identification of relative health. Further, each system covered contains graphs to capture and trend any MR Functional Failure. The system performance concludes with documenting those actions needed to improve system performance to the next higher health rating, including those actions needing to be performed to maintain the items in the highest category. In the 2008 report, 65 systems are covered; the Maintenance Rule covers all except three. For example, starting this quarter, the plant's Cathodic Protection System (CPS) is included. The reason is to increase the awareness of this system. The underground fuel oil lines to the emergency diesel generators (EDGs) are to be replaced this year. In the performance of these tests, components are rated as GREEN, WHITE, YELLOW, and RED (from good to bad). Installation of a dedicated CPS for the EDGs is planned to restore the Nuclear Safety Rating to GREEN.

The Team noted the plant health performance indicators and the report's supporting information are of high value to assuring high system availability and reliability at the station. The Team found that the Plant Health Report is an **Area of Strength**.

#### **2.4.3 Assessment of the Component Health & Trending Process**

A major element of FENOC's efforts to achieve operational excellence is the establishment of a comprehensive maintenance strategy. One focus of this strategy is the continuous improvement of equipment performance. NOP-ER-1001, "Continuous Equipment Performance Improvement," guides the establishment of this effort.

Plant-specific business practices were developed for establishing an equipment performance improvement effort at Davis-Besse, starting with NOBP-ER-3900, "Equipment Reliability Common Definitions and Structure," that defines the tools and resources needed to assist the plant staff in identifying the components to be followed, their performance history, maintenance (predictive, preventive, replacement, etc.), risk importance, and other data of importance. A Equipment Reliability Work Bench (an in-plant computer program capable of collecting and processing component maintenance data from existing plant databases such as CREST and SAP) was developed, which includes 16 subprogram modules. This program is now fully operational and has the potential to provide valuable support to the maintenance activities at the station. The Nuclear Operating Business Practice Component Health and Trending (CHT) Process (NOBP-ER-3916, Rev 0, effective date 1/26/2007) defines the 16th module that provides component trending data Fleet-wide.

The efforts to complete the CHT module were accelerated in response to a 2005 Confirmatory Order Independent Assessment (COIA) Team "Area for Improvement" concerning the need for trending equipment problems across systems. During 2006, templates were developed for 17 major classes of components and computerized. During 2007, the data population of the templates began. Roughly 70,000

components are currently defined in the database, counting both critical and non-critical components within the 17 component classes. These are the Fleet-wide components from the Beaver Valley, Davis-Besse, and Perry stations.

The Team reviewed the CHT data plots for the third Quarter 2007 and the first Quarter 2008. The 2008 data shows that about 90% of the component trend data has been entered into the database. The data plots were reviewed for accuracy and value. The following is the Team's assessment:

- **CR & Corrective Maintenance Order Trends**

These plots graph the number of CRs and orders over the past 17 calendar quarters. The trends may flag increases in corrective maintenance and needed corrective actions. The Team identified several problems in the plots involving incorrect linear averaging lines, false data points, and the improper treatment of blank entries. These problems are known to the plant staff; the computer program is scheduled to be corrected.

The Team reviewed a limited number of the corrective maintenance orders factored into the plots and found few that indicated possible component failure. This demonstrates that the CR and order trends are not indicative of the trend of failures. The Team observed that component failure rate data should be added to the CHT report as a more precise measure of component health related to plant risk. Identifying failures would also satisfy objectives 4.2 (4 and 9) of NOP-ER-1001.

Failure rates of certain critical components are already being reported to the EPIX system; the station's Probabilistic Risk Assessment (PRA) staff also collects station failure rate data to update the PRA model; however, such data are not trended in CHT. If failure rate trending is incorporated, there needs to be a differentiation between continually operating components versus standby components; failure rates of continually operating components are generally in terms of failures per hour, while standby component failure rates are generally in terms of failures per demand.

- **Average As-Found Condition Trends**

These plots graph the average as-found condition based on the following weighting factors: condition is Excellent, weighted as 5; condition is Above Average, weighted as 4; condition is Average, weighted as 3; condition is Degraded, weighted as 2; and condition is Failed, weighted as 1.

The Team observed that this trend measure could have value after some experience with its use. Most quarterly values range around 3.0, but even slight moves downward or upward may signal degrading or improving trends. More experience with this measure is needed to establish whether a certain trend is indicative of a problem needing attention.

- **Predictive Maintenance Data**

Thermography, oil chemistry, vibration, and acoustics are among the predictive technologies used at FENOC. The CHT reports the average of such data for each component class, providing some understanding of the overall health of the component based on the predictive maintenance completed during the past quarter. As with the as-found trending, this may be a valuable trend parameter, but requires further experience and SME evaluation before it can be trusted.

The window colors, GREEN, WHITE, YELLOW, and RED have not been set for the 17 component classes in the last two quarters. According to the CHT owners, this is because of a computer program

issue that blocked certain data from being processed. Currently, if there is an adverse trend in the CHT data, it is not being shown via window color until this computer problem is eliminated.

It is evident that even though the Module 16 computer work is nearly complete, with a few plotting errors needing correction, further experience is needed to develop the window color criteria and to provide trending determinations with confidence. As indicated in the first bullet above, to satisfy objectives 4.2 (4 and 9) of NOP-ER-1001, adding component failure data to the CHT appears necessary. This is an **Area in Need of Attention**.

#### **2.4.4 Assessment of Monthly Performance Reports**

The Team reviewed the Davis-Besse Nuclear Power Station Monthly Performance Reports, January through May 2008. Nearly 60 trend graphics are used to report the station's status in the following broad areas:

- Safe Plant Operations (includes human performance and CRs)
- Reliable Plant Operations
- Costs
- People, Processes, and Procedures (includes training, hiring, chemistry, engineering, operations, radiation protection, maintenance, and work management)

The Team noted the trend graphics generally provided the month's performance along with the past 11 months of data. The indicators also documented gap closure plans when undesired trends require action.

#### **2.4.5 Assessment of Human Performance Trending**

Although human performance has recently improved according to recent IPA reports, it remains one of the highest areas binned and continues to be a focus area. For this reason, the Team reviewed this area. Both the Monthly Performance and the IPA reports contain human performance trends. The "monthlies" trend the following:

- Personal Safety Incidents
- Human Performance Success Days (number of days without an inappropriate human action)
- Error Rate
- Precursor Error Rate

The IPA trend binned symptom groupings that relate to human performance such as:

- Procedure Non-Compliance
- Program Non-Compliance
- Self-Checking Inadequate
- Not Cognizant of Surroundings
- No Peer Checks
- Inattention to Job/Detail

A Team member attended the July 15th Human Performance Team meeting. This team is composed of representatives of 21 major work sections of the station. These are part-time section human performance advocates lead by a full time station human performance advocate. The team meetings focus on individual issues brought in by members, but also work on generic issues based on the human performance trends. Current focus concerns the need for reducing the rate of self-check errors and increasing the use of peer checking. The station's Success Lab and other human performance training are being looked at to improve the training and to require refresher training where necessary. The human performance team believes all station personnel would benefit from the general human performance training already in place. Also human performance training for supervisors is being discussed to provide an understanding of the supervisor's role in supporting continuous improvement of human performance at the station.

The Team noted that the human performance indicators are adequate for flagging human performance issues, though it is necessary to conduct in-depth analyses of the associated CRs to better understand the generic causes underlying any human performance adverse trend.

#### **2.4.6 Assessment of Corrective Action Program Indicators**

Five CAP performance indicators are found in the monthly performance reports. They are as follows:

- SCAQ Root Cause Evaluations
- Condition Adverse to Quality (CAQ) Root & Full Apparent Cause Evaluations
- Open Condition Reports
- Condition Reports Open > 180 days
- Open Long Term Condition Reports – 123 are open

The Team found that the CAP indicator datasheets provide good insights concerning timeliness, quality, and closure of CRs.

#### **2.4.7 Summary**

Davis-Besse trending processes continue to provide valuable information. CRs are written when an adverse trend becomes apparent; management attention to adverse trends is resulting in proactive corrective actions. The IPA process and the Plant Health quarterly reports are working well, with the timely identification of adverse trends. Component trending needs further work to be effective, but the overall effort to establish a comprehensive maintenance strategy is within reach. A reporting mechanism for this promising, but complex effort would be beneficial.

#### **Areas of Strength**

The IPA process provides a strong means of identifying, managing, and correcting problems while the Plant Health Quarterly Reports provide detailed summary of the health of the station's systems and the activities being conducted to assure their availability and reliability.

#### **Areas in Need of Attention**

The Component Health & Trending plots contain errors requiring correction; further experience is needed to develop window color criteria and to provide trending determinations with confidence; and the addition of component failure data is required to satisfy objectives [4.2 (4 and 9) of NOP-ER-1001].

## Areas for Improvement

None

## Conclusion

The Team rated the *Trending Program Implementation and Effectiveness* as HIGHLY EFFECTIVE.

## 2.5 Effect of Program Backlogs

The Assessment Team performed an analysis of the effect of program backlogs on organizational and operational effectiveness. The Team's assessment consisted of:

- a. Reviewed program backlogs and the trend of the backlogs; and
- b. Evaluated the impact of the backlog and backlog trend on organizational and operational effectiveness.

The Team reviewed the status of the backlog of open and unresolved work items at Davis-Besse. This was conducted through a series of interviews with plant staff and a review of the Davis-Besse databases, reports, IPAs, and numeric summaries.

### 2.5.1 Program Backlogs and Backlog Trend

#### Review of Self-Assessment Report DB-SA-07-085, Evaluate Performance of the Open Condition Report Closure Plan, 1/17/2008

Assessments of the backlog of open CRs conducted in 2006 resulted in the creation of an *Open Condition Report Gap Closure Plan*. This snapshot self-assessment was to evaluate performance of that Plan to be able to address the CAP backlog while continuing to manage and focus resources on current issues.

This Davis-Besse assessment concluded that the implementation of the Plan in combination with CAP program changes has resulted in the closure of a majority of the targeted corrective actions and a substantial reduction in the average age and number of open CRs. The assessment further recommended that the Plan was no longer needed since the number of open short-term CRs has been reduced below the FENOC Business Plan goal, which represents industry top-quartile performance.

The Team found that the self-assessment provided several comparisons of recent backlog totals compared to that in existence at the beginning of the Plan (2006) in order to show sufficient results of the "gap closure." The assessment concluded that "any additional action necessary to achieve the monthly performance report goals for the CAP could be tracked through an *Open Condition Report Gap Closure Plan* for the respective performance indicator."

The Team noted that the Station CAP backlog performance resulted in meeting the station goal for open (short-term) CRs to be less than 500; however, the timeliness goal for completion of actions, namely the number of open CRs with actions over 180 days, was not met. This metric in the May 2008 performance indicator report is also listed as RED with 74 CRs vs. the goal of less than 40 CRs with timeliness greater than 180 days.

The Team also noted that this assessment did not address the fact that the monthly performance improvement (PI) report has no metric or criteria for open long-term CRs that were removed from the list

of “open CRs,” nor metrics on age of CRs, especially those classified as significant. It was noted that at one of the peer assessor sites, the number of extensions is trended as a measure of performance.

#### **Review of the Davis-Besse Nuclear Power Station Monthly Performance Report for May 2008.**

The Team reviewed the May 2008 report to assess the type of performance indicators being trended especially to evaluate the ability to manage the backlog of significant deficiencies at the station and affecting the implementation of the CAP.

The executive summary describes the overall CAP indicator as RED performance for the month. WHITE inputs were due to one S and one C root and apparent full cause evaluations being completed late. The station wrote an *Open Condition Report Gap Closure Plan*, via CR 08-38874, to provide lessons-learned to stress the importance of mentoring newly qualified cause analysts. The Team considered this to be appropriate action as a follow-up.

The number of open short-term CRs was meeting the goal of < 500 and was considered GREEN. This indicator measures the ability of the organization to manage the workload of open short-term CRs in the investigation phase. CRs with dependencies to refueling outages and long-term modifications are eliminated from this measure. The Davis-Besse staff indicates that this is “top quartile” industry performance. However, the numbers of long-term CRs open greater than 180 days was RED. There were 74 vs. the goal of < 40. In response, Davis-Besse management established a Site Leadership Team agenda item for Department Managers to present their corrective actions and give the current status. In addition, the number of open long-term CRs tied to refueling outages and projects is reviewed, but with no goals for the measure.

The Corrective and Elective Maintenance (on line) backlog indicators reflect GREEN and WHITE performance, respectively.

The Control Room Deficiencies indicator was GREEN, with two open non-outage items. The Operator Work Around items for which compensatory operator actions are needed for abnormal or emergency conditions) and Operator Burdens (a condition where compensatory operator actions are necessary for normal plant operations) indicators were both GREEN with no non-outage items at the end of May 2008. The Team determined that this was very good performance for these high priority operational items. This high level of performance is considered an organizational **Area of Strength**.

Although considered an overall Strength, the Team questioned about the one remaining Operator burden for the MFP 2 seal water temperature control valve not controlling temperature. This condition appears to have been identified in May 2006 and was scheduled to be repaired in 15 RFO. The Team interviewed the Manager of Plant Engineering and learned that this is not a significant operational problem and that, although it was investigated during the 15 RFO, it will need a complete seal replacement, which is now scheduled for 16 RFO.

During the 2007 COIA assessment, the total number of open CRs (short- and long-term) was about 708. In early 2008, the Davis-Besse site changed the definition of their performance indicators and split the previous category into two, short- and long-term open CRs. If the totals in May 2008 are added together, there are 417 short-term and 123 long-term CRs, for a total of **540** open to compare with the **708**, demonstrating a reduction in the backlog and the ability to maintain a focus on “today’s problems.”

### 2.5.2 Review of the Oldest Significant Root Condition Reports (SR CRs)

The Team reviewed the status of the oldest Significant Root Causes Condition Reports (SR CRs) to determine whether the site was placing the appropriate attention to correcting these most significant issues in the plant.

#### Age of Oldest SCAQ Condition Reports

	2005 Assessment	2006 Assessment	2007 Assessment	2008 Assessment
Average Age of 8 Oldest SR CRs	540 days	830 days	747 days (8 CRs)	1,236 days (8 CRs) 224 days for those 3 CRs with actions remaining
Oldest Preventive Action	1,219 days (outage)	1,610 days (outage)	1,579 days	1,974 days (CAQ non-S, outage)
Oldest Remedial Action	862	1,224 days	1,450 days	2,011 days (CAQ non-S)

During this independent assessment, there were only eight SR CRs open and of those eight, only three had corrective actions open. This shows continued improvement in managing the oldest SR CRs as part of the “backlog.”

The SR CRs included the following:

- 02-00784, Collective Review the Nuclear Fuel Related CRs for Common Causes
- 02-06178, Spacer Grid Damage Observed During Fuel Inspections
- 03-00357, CATS Rollover- Closure CR for PCAQR 98-0553
- 06-6003, Manual Reactor Trip Due to Lowering Condenser Vacuum
- 07-18074, HPI Train 1 Discharge Piping –Potential Air Intrusion
- 07-29410, TS Violation Due to Both CTRM Rad Monitors Out of Service (effectiveness review)
- 07-32122, Pressurizer Level Decrease While Placing DH Train 1 in Standby
- 08-36573, Inadvertent Addition of Station Air Into the Condenser Causing Degraded Vacuum

The Team review determined that the oldest four SR CRs only had the final closeout checks or the effectiveness review following all corrective actions, to be performed. In addition, of the remaining CRs, only three had corrective actions other than a final effectiveness review remaining to be implemented. These CRs had an average age of 224 days, which demonstrates significant progress from the past several years for the significant CRs.

### 2.5.3 Review of Oldest Condition Reports

The Team reviewed the oldest eight CRs to assess the original condition, the reasons for the delays in closure, the basis for extensions if any, and the current plans. The following CRs were reviewed:

**CR 02-00784, SR, Collective Review the Nuclear Fuel Related CRs for Common Causes**

This CR has all corrective actions completed and is currently under final review prior to closeout.

**CR 02-02340, AA, Catholic Protection**

This CR is presently funded and scheduled to be implemented in several phases, with the first phase modification issued for implementation on the EDG fuel oil piping during 2008. Phases II and III are scheduled for 2010 and 2011.

**CR 02-02897, AA, Boric Acid buildup on equipment in BAAT RM**

This CR was to correct boric acid on the flange of MU 23. There were eight extensions to the corrective action. The extension request required by NOP-LP-2001 is required to address the risk of extension and any interim compensatory measures. The latest extension for this deficiency states "the boric acid system is operable and capable of performing its intended function. I have discussed this with the system engineer and he concurs in this request. The risk associated with this extension is negligible."

This work was deferred due to resources and is currently scheduled for the week of 8/11/2008.

**CR 02-04925, AA, 480VAC Substation Transformer Issues**

This CR was written to identify and correct several deficiencies with transformers based on system walk downs. The corrective action #1 to repair an oil leak with "Pig Putty" was ineffective. There were nine extension requests for this corrective action and the last was approved on 10/2/2007 by the site Vice President to extend the action to 11/24/2008. The extension request indicates that the repair is beyond the expertise of the shop and the site is evaluating bids for work by a vendor. This bid was being evaluated for acceptability and funding and will be rescheduled later.

The extension request justification indicates that the transformer is currently operable and the request was discussed with the system engineer. No discussion of risk or any interim measures was included as required.

**CR 02-05039, AA, EDG System Does Not Meet IEEE –STD-387-1972 Requirements**

This corrective action involves a modification to the EDG equipment. Portions of several corrective actions have been scheduled and implemented over past refueling outages. The remaining action, to implement EWR 01-0261-00 (EDG breaker auto opening logic), is currently scheduled for 16 RFO.

The fourth extension request, approved on 2/27/2007, for providing an update to Operations for DB-OP-06316 indicates that there is minimal risk and that the EDGs are declared inoperable when the operator action would be required. Interim corrective actions are instructions in DB-OP-06316, DB-SC-03076, and DB-SC-03070 to open the tie breaker between essential and non-essential 4 KV busses if there is an indication of a loss of off-site power or level 2 Safety Features Actuation System (SFAS).

**CR 02-05306, AA, Makeup System Walk down, RM 211, Boric Acid**

This CR was written to correct several identified deficiencies involving valves leakage in the makeup system. Valve MU 104 corrective action was deferred, and the second extension request was approved on 3/27/2008 to be completed in the next refueling outage 16 RFO. Justification was provided that periodic inspections are performed, and that the materials involved are stainless steel. The extension form indicates "no increase in risk results from this extension, nor are any interim actions required."

### **CR 02-05755, AA, SHRR-Recommend SFAS Mod 00-0019 Be Implemented Prior to Restart**

The remaining corrective action is to remove abandoned equipment. These radiation monitors were removed from the SFAS system. Engineering Change Request ECR 03-0138-00 to perform the roll back of the cables to the four containment radiation monitors was completed during 13 RFO. The corrective action extension request is based on the low priority of the modification needed to complete the final removal of unused equipment. This is presently scheduled for 16 RFO.

### **CR 02- 06178, SR, Spacer Grid Damage Observed During Fuel Inspections**

All corrective actions included in this CR have been completed, including spacer grid design changes by the fuel manufacturer, and the CR is in the process of the final effectiveness review.

The station is also currently experiencing a fuel failure, and the station requested that the effectiveness review be performed accordingly.

The Team determined that the above old CRs, for the most part, were delayed in having corrective actions implemented due to planned low priority scheduling issues. The site management had reviewed these issues and evaluated the extensions and had these extensions approved.

The Team further performed a qualitative assessment of the components involved and determined that the site had provided a basis for the extensions; however, the justification for the extensions did not always include an evaluation of the risk of delaying corrective action and consideration of interim actions. This was somewhat inconsistent and typically related to the corrective actions related to low priority Orders and rescheduling of Order-related corrective actions for a future system or refueling outage.

## **2.5.4 Evaluation of the Backlog Trend**

### **Review of “Open Davis-Besse Site Documents”**

The Team reviewed this report in order to get a “big picture “of the global measure of the amount of “work” that each section and department has as already identified in order to assess the station’s performance and ability to keep up with the generation rate of new issues and to be able to focus on the most risk and safety significant issues.

Site “documents” includes many categories of items, each of which refers to some measure of work that needs to be accomplished by the various work groups at the station. This includes items such as work orders, CR evaluations, Corrective Actions, Engineering evaluation requests, Updated Safety Analysis Report updates, design changes, OE reviews, PM upgrades and revisions, other procedure revisions, and all outage work tracked separately.

<b>As of (date)</b>	<b>3/23/2008</b>	<b>6/15/2008</b>
Total number of open site documents	4,547	4,403 (8,124 with outage items included)
Number of CRs	140	141
Number of Work Orders (on line)	1,649	1,672
Number of corrective actions	445	432

This table illustrates that for the three-month period the amount of “backlog,” as represented by the number of open site “documents,” was relatively constant.

However, when a longer-term trend is reviewed including outage items, it appears that there is a slight increase in the backlog. A number of these long-term items are related to Engineering products and several Preventive Maintenance Template revisions.

As of (date)	7/8/2007	7/6/2008	Comments
Total number of open non-outage site documents	4,290	4,426	Compared to steady state stretch target of 3,852
Total Site documents including outage items and PM Template reviews	6,820	8,975	Increase in “grand totals”
Number of open non-outage corrective actions	474	422	
Total number of non-outage Engineering items (design, plant, tech. services)	1,171	1,052	
Total number of site documents including outage and PM Template reviews for Engineering	2,536	4,729	Includes increase in PM feedback forms and revisions in order to respond to an improvement item to align the PM program to EPRI PM Templates

The Team concluded that the “backlog” of deficiencies is relatively constant and manageable; however the total workload is slightly higher due to the one-time effort to upgrade and optimize the PM Program.

### 2.5.5 Peer Benchmarks

The Team peer reviewers provided the following comments for the purposes of “benchmarking”:

#### Backlog

Non-routine corrective actions at another utility site are typically implemented within 90 days versus 135 days at Davis-Besse.

#### Other

Based on the walkdown performed on 7/10/2008, the Team noted that both DH Pumps Train 1 and Train 2 had catch containers installed. Engineering review determined at a CR had not been submitted for Train 2. CR 08-43046 was submitted to evaluate the condition and include a Boric Acid Inspection Report. Additionally, a walkdown was performed to review other ECCS pumps to ensure a similar condition does not exist. In general, catch containers for seal leakage on safety related pumps do not appear to meet station or industry standards for long periods of time.

### 2.5.6 Summary

The Team determined that the station performance in addressing the backlog of old CRs continued to show improvement. Current total numbers of “open documents” representing the global amount of work can be maintained while being able to focus on current day-to-day issues. A recent self-assessment

provided a summary used for justification to close the *Open Condition Report Gap Closure Plan*. Interviews continue to support Management support of and attention to the backlog. Peer reviews indicate that management expectations and standards can continue to be raised compared to industry standards.

### **Areas of Strength**

The low number of Operator Workarounds and Burdens, as well as Control Room Deficiencies, is considered a Strength.

### **Areas in Need of Attention**

None

### **Areas for Improvement**

None

### **Conclusion**

The Team rated the *Effect of Program Backlogs* as HIGHLY EFFECTIVE.

## **2.6 Effectiveness of Internal Assessment Activities**

### **Self-Assessments**

The Assessment Team evaluated the effectiveness of the Davis-Besse Nuclear Power Station's self-assessment activities associated with the implementation of the CAP. The Assessment Team:

- a. Reviewed the results of Davis-Besse Nuclear Power Station assessments/reviews conducted since the 2007 Independent Assessment of the Corrective Action Program and determined whether the assessments/reviews were comprehensive and whether effective actions were taken to correct problems or weaknesses identified;
- b. Evaluated the effectiveness of self-assessment capability by reviewing findings and corrective actions associated with the following:
  - i. Focused self-assessment reports,
  - ii. Nuclear Oversight Assessments/reviews (including assessments/reviews of both onsite and offsite safety committee activities), and
  - iii. Evaluations conducted on the implementation of the CAP since the 2007 Independent Assessment;
- c. Determined if the Davis-Besse Nuclear Power Station is aggressive in correcting self-assessment findings on the implementation of the CAP by determining whether the corrective actions are adequate, timely, properly prioritized, and that effectiveness reviews are ensuring the desired results; and
- d. Interviewed selected individuals involved with the oversight function, as well as the audited organization, to gain their insight on the effectiveness of their effort and the responsiveness of FENOC management and staff to CAP issues raised.

## Onsite and Offsite Safety Review Board Activities

The Assessment Team evaluated the effectiveness of the Company Nuclear Review Board's oversight of the implementation of the CAP since the 2007 Independent Assessment of the Davis-Besse Corrective Action Program (August 2007) by reviewing minutes, assessments/reviews, or other actions initiated by the board as they relate to risk significance or major corrective action successes or failures. The Assessment Team reviewed the following, as necessary:

- a. Identified what issues are reviewed by the safety review committees and reviewed actions initiated by the safety committees to identify, assess, and correct areas of weakness;
- b. Reviewed assessments/reviews of the CAP conducted since the last Independent Assessment under the cognizance of the offsite safety review board and determined if the assessment/review findings were consistent with such external assessments as INPO, NRC, and consultants; and
- c. Evaluated the Davis-Besse Nuclear Power Station's follow-up on the CAP identified by the safety review boards, including board-initiated assessment/review findings and any recurring problems.

### 2.6.1 Evaluation of Davis-Besse Oversight/Audits of the CAP

The Team reviewed three Oversight Quarterly Performance Reports completed since the 2007 COIA CAP Assessment (DB-PA-07-03, third Qtr 2007; DB-PA-07-04, fourth Qtr 2007; and DB-PA-08-01, first Qtr 2008). Focusing on the oversight of CAP implementation, the Team found that the reports covered a broad spectrum of CAP activities that included (1) inconsistencies in documenting operability reviews by a Senior Reactor Operator, (2) Oversight having to prompt organizations to write CRs, and (3) several cases where CRs were not generated when adverse conditions were identified. These reports contained well-supported findings for individual areas audited, with cross-cutting issues noted only during the first Quarter of 2008 that identified human performance errors occurring in multiple functional areas in operations, maintenance, and radiation protection. These issues resulted in a Station clock reset (radiation protection), a 12-hour delay in the refueling outage and elevated on-line dose rates (maintenance), a reactivity management event, and a mis-positioning event that resulted in an unscheduled entry into TSS (operations). These human performance events have been recognized by site management and documented in the CAP. A common cause evaluation is being performed for these issues.

Oversight report results determined that the CAP, for two of the four quarters through the first quarter of 2008, was EFFECTIVE, as documented in the Performance Assessment Ratings of the quarterly reports; and was based on observations of the CARB, the management alignment and ownership meeting (MAOM), the MRB, reviews of CR timeliness, reviews of corrective action scheduling, and operability reviews performed by operations.

The CNRB and the World Association of Nuclear Operators (WANO) expressed concerns that workers were sometimes misapplying guidance for determining if a problem meets the criteria of an adverse condition that warrants reporting on a CR. Performance Improvement issued a site-wide communication that included examples of adverse conditions that should have been documented on a CR and a reinforcement of CR initiation expectations.

The Oversight group occasionally challenged CR reviews at the MRB and determined that the MRB is being conducted efficiently and effectively. Conditions identified as a result of improper human performance were reviewed for precursor errors or the need for an event-free clock reset review. A review

of open CRs was performed weekly at the MAOM and ensured personnel maintained awareness of timeliness requirements for CR completion.

Most notable improvements recognized within the CAP were related to implementation during 15 RFO as compared to the previous outage 14 RFO. Oversight identified early in the outage that CRs were not being generated to document issues, and the outage organization took prompt action to communicate the importance of CR generation. Oversight personnel worked with the scope/notification review team to ensure personnel were aware of the importance of and the requirements for generating CRs. In several cases, Oversight personnel prompted station personnel to generate CRs and improvement was noted as the outage progressed.

Oversight identified that the categorization of CRs by the MRB may not always be appropriate. The apparent cause category was not being selected when it was appropriate to do so and as a result, Performance Improvement personnel challenged the board to ensure that categories were appropriate. Performance Improvement was proactive by pointing out that inappropriate categories were being assigned to CRs documenting critical component failures. Several CRs documenting these failures were assigned a Fix category. This was determined not to be acceptable; an apparent cause was necessary for evaluation of these failures

The Team noted that CAP trending and analysis results for recurring issues documented challenges to the 15th refueling outage continued with two milestones being missed and several others having their due dates extended. Oversight identified several challenges to station management in the last three quarters that include increased management attention needed due to continued missed/rescheduled milestones, concerns for contractor in-processing and training, ensuring the ALARA targets and dose performance are met, and planning for future outages to develop meaningful goals to arrive at an achievable outage plan. Recent challenges were equipment in degraded conditions.

The Team also interviewed individuals involved in the audit process to ascertain their insights on the value-added by the Oversight processes and the responsiveness of Davis-Besse staff to oversight results and potential findings. These individuals covered a spectrum of line personnel, Oversight managers, performance- and compliance-based auditors and assessors, and CAP administrators. In general, the staff and management were very receptive to Oversight findings. The Oversight staff believes the line organizations and management are responsive to audit and assessment findings and communication between these groups have improved.

## **2.6.2 Evaluation of Davis-Besse Self-Assessment of the CAP**

To evaluate the effectiveness of the Davis-Besse self-assessment of the CAP, the Team assessed the depth and quality of self-assessments and the scope and timeliness of corrective actions taken for identified findings.

The Team reviewed seven self-assessment reports completed since the 2007 Independent Assessment to determine the depth of review, the level of criticality, and the significance of the findings. During this assessment, several other self-assessment evaluations applicable to the CAP were identified and those findings were also evaluated by the Team. The Team evaluated the aggressiveness of the Davis-Besse staff in correcting self-assessment findings on the implementation of the CAP. This included determining whether the self-assessments were adequate, timely, and properly prioritized and whether effectiveness reviews were ensuring the desired results.

Davis-Besse performed Focused IPAs and snapshot self-assessments in accordance with NOBP-LP-2001, "FENOC Self Assessment/Benchmarking Practice." The self-assessment schedule is derived annually,

based on management's collective judgment of priority needs. Senior site and corporate management participation in this process reinforced management support of the self-assessment program. "Snapshots" were performed as effectiveness verifications prior to significant outside inspections or when a manager perceived the need for performance adjustment.

The Team noted that while the number of IPAs (30 total) have increased, the number of snapshot self-assessments and Focused self-assessments has decreased slightly. There are currently only four Davis-Besse Focused self-assessments scheduled for 2008, and only one assessment of Condition Report Initiation was performed in June 2008. Currently, Davis-Besse has 25 snapshots logged for 2008 when in comparison to 2007, there were a total of 31, and in 2006, there were 39 snapshots logged for the entire year. There has been a reduced number of assessments focusing on the CAP process due to the improved health of the program, and focus has shifted to other areas.

#### **DB-SA-07-043, Collective Review of Three Station Events**

In response to a CNRB concern, Davis-Besse performed a collective review of three recent RCEs to determine whether there are any current organizational issues (questioning attitude, management decision making, CAP breakdown) similar to prior plant performance weaknesses. The three station events reviewed were addressed in CR 07-15275 for the emergency diesel generator voltage regulator loose connections, CR 07-18003 for disabling the seismic monitoring system impacted emergency assessment capability, and CR 07-18074 for high pressure injection Train 1 discharge piping voiding. The self-assessment did not identify any common organizational issues similar to those identified at the time of the reactor vessel head degradation event. However, a common factor in these events, as well as other recent assessment findings, involved the ineffectiveness of actions taken in response to site review of operational experience documents to prevent the occurrence of similar events at Davis-Besse. CR 07-25988, Using Operating Experience Effectively to Prevent Events, was written to address this finding.

The Team found that the assessment was comprehensive, the findings were justified, and the documentation was complete. The CNRB closed their concern in September 2007. CR 07-25988 concluded that the apparent cause of the ineffective OE reviews was a lack of rigor on the part of subject matter experts. Corrective actions included remedial discussions with Section OE coordinators and a program change to require verification of the implementation of SOER recommendations. The Team found these actions acceptable.

#### **DB-SA-07-085, Evaluate Performance of the Open Condition Report Closure Plan, 1/17/2008**

Assessments of the backlog of open CRs conducted in 2006 resulted in the creation of an *Open Condition Report Gap Closure Plan*. This snapshot self-assessment was to evaluate performance of that Plan to be able to address the CAP backlog while continuing to manage and focus resources on current issues.

This assessment concluded that the implementation of the Plan, in combination with CAP program changes, has resulted in the closure of a majority of the targeted corrective actions and a substantial reduction in the average age and number of open CRs. The assessment further recommended that the Plan was no longer needed since the number of open short-term CRs has been reduced below the FENOC Business Plan goal, which represents industry top-quartile performance.

The Team found that the self-assessment provided several comparisons of recent backlog volume compared to that in existence at the beginning of the Plan (2006) in order to show sufficient results of the "gap closure." The assessment concluded that "any additional action necessary to achieve the monthly performance report goals for the CAP could be tracked through an *Open Condition Report Gap Closure Plan* for the respective performance indicator."

The Team noted that the station CAP backlog performance resulted in meeting the station goal for open (short-term) CRs to be less than 500; however, the timeliness goal for completion of actions, namely the number of open CRs with actions over 180 days, was not met. This metric in the May 2008 performance indicator report is also listed as RED with 74 vs. the goal of less than 40 CRs, with timeliness greater than 180 days.

The Team also noted that this assessment did not address the fact that the monthly PI report has no metric or criteria for open long-term CRs that were removed from the list of "open CRs," nor metrics on age of CRs, especially those classified as Significant.

#### **DB-SA-08-049, Condition Report Initiation (CA 07-26489-4)**

The purpose of this assessment was to perform an effectiveness assessment to check for the effectiveness of corrective actions implementation for CR 07-26489, WANO 2007 – AFI PI.2-1, Some Problems not Addressed in a Timely or Effective Manner. This assessment identified a noteworthy positive for Maintenance generation of CRs for new items found while performing maintenance and PMs and for identifying lower level items on CRs. A noteworthy negative, although improvement was noted, was identified in the timeliness of initiating CRs and also in tracking self-assessment noteworthy items in the SAP notification process versus the CREST Corrective Action Program.

The team reviewed the report and found it to contain extensive CR initiation trending numbers with comparisons to other sites in the FENOC Fleet. The identification of Davis-Besse conditions adverse to quality continues to increase: (first half 2007 = 1582 total, second half 2007 = 1823 total, first half 2008 = 2736 total). The assessment identified both positive and negative noteworthy areas and was self-critical.

#### **DB-SA-08-023, Davis-Besse Site Roll-Up (2nd half of 2007) Integrated Performance Assessment (IPA)**

Davis-Besse conducted an IPA for the period between 7/1/2007 and 12/31/2007. The primary focus of the site during this assessment period was preparation for the 15th Refueling Outage and, although there were initial issues with meeting milestones, the site finished the period prepared to enter the outage on 12/30/2007. For the assessment period, no adverse trends were identified; however, two items were noted as areas where further evaluation is desired to identify performance improvement. The station identified a Negative Noteworthy Item in the area of human performance. It was assessed that the station has improved human performance over the previous period, but this area remains one of the highest and continues to be a focus for performance improvement opportunities and initiatives. In addition, an Emerging Trend has been identified in the area of Equipment Degradation (52 CRs) through analysis of the highest site-wide binning categories. The assessment team noted an evaluation of the increased number of CRs binned in this area is necessary to determine if further action is required. There were three Station event-free clock resets during the period covered by this assessment (sprained ankle, knee injury and gas voiding in the #1 DH discharge piping).

Some highlights of the assessment period include: industry top quartile on-line dose performance; outage preparations began by struggling with meeting the accelerated milestones, but after recovery actions were taken, the site was better prepared for 15 RFO than any recent outage; the successful INPO/WANO evaluation; continued high level performance by the Emergency Response Organization; and the completion of the CAP backlog reduction plan. Based upon the above, the overall performance of the Davis-Besse site has been rated as Effective by the site management team for the period covered by this assessment.

The Team noted this assessment to be self-critical in identifying Emerging Trends, Areas For Improvement, and Negative/Noteworthy Items to enhance the overall process.

### **DB-SA-07-062, Davis-Besse Site Roll-Up (1st half of 2007) Integrated Performance Assessment (IPA)**

Davis-Besse conducted an IPA for the period between 1/1/2007 and 6/30/2007. For the assessment period, no Negative Emerging Trends were identified; however, three items were noted as Areas for Improvement/Negative Noteworthy Items in the areas of Human Performance (600406717), Procedure Content (CR 08-25279), and the Outage Management Process (CR 07-25259). The assessment found that corrective actions had been put in place to correct the decline in human performance, but were focused on correcting supplemental worker behaviors that cannot be truly evaluated and sustained until they are tested in future outages. There were two Station clock resets during the assessment period that involved entry into a High Radiation Area on the wrong Radiation Work Permit, and the second was an OSHA recordable injury inside the Protected Area.

The assessment included a review of CRs and unsatisfactory/coached observation data to identify leading negative items; many of the high incidence categories had improved during the assessment period. NRC Inspection Report 2007-006 mentioned Operations procedure backlog reduction was an Area in Need of Attention. This was correlated with the high number of CRs in the procedures area.

The assessment team consensus was that the Outage Management Process is not fully effective in preparing the Davis-Besse site for a successful outage. The outage management issue was also identified by the CNRB in their 2/9/2007 meeting minutes. Fleet Oversight also documented the identification of a process improvement issue that they observed in the Outage Management Process in CR 07-22693. Since outage performance has been identified as an issue for all three sites and outage management is critical to a successful outage, this issue may need to be rolled up to the Fleet level. CR 07-25259 has been written to evaluate this Area for Improvement and determine potential corrective actions to provide the site with tools to improve performance in this area.

The team found this assessment to be self-critical, identifying several areas for improvement, and conservative decision making was apparent in identifying the weaknesses in the Outage Management Process and elevating them to a higher level through this process.

### **DB-SA-07-061, Integrated Performance Assessment for Regulatory Compliance (DBRC) Section & Performance Improvement Unit (PIU)**

This Integrated Performance Assessment Report was prepared using the guidelines provided in NOBP-LP-2018 and the methodology described in this report and covers the period 1/1/2007 through 6/30/2007. Several Negative/Emerging Trends and Areas for Improvement/Negative Noteworthy Items were identified as a result of this evaluation that include: (1) CRs coded as "Created in Error" did not provide enough information to properly process, and (2) the Section event-free clock resets provided little added value due to reset requirements.

The assessment team found, during the review of this IPA, that there was a significant drop in the number of CAP CRs during this assessment period (74 to 25), which was attributed to several things: (1) the implementation of the new version of CREST no longer seems to be an issue; (2) continued focus on CAP implementation issues, such as backlog reduction, timeliness of reviews, missed due dates, and CR initiation vs. notifications seems to have improved performance in this area; and (3) continued improvement in quality of evaluations and corrective actions due to CARB and PIU emphasis on providing useful feedback.

The assessment team found this report to include meaningful results of CAP trending that identified improved performance in implementation issues and the CREST database, with continued improvement noted due to the positive feedback being received from the CARB and the PIU sections.

### **DB-SA-08-027, Review of Outage Limited ACEs**

The purpose of this assessment was to review and assess completed LACEs initiated during Davis-Besse 15 RFO. The objectives were to assess whether the evaluator was trained to perform a LACE and to ensure the LACE had been performed in accordance with procedure NOBP-LP-2011, "FENOC Cause Analysis." The assessment was performed as a result of a FENOC OE, and the outage presented an opportunity for evaluators that infrequently perform LACEs to do these types of evaluations.

Of the 16 LACEs reviewed, two (CR 08-32667 and CR 08-33292) were found that did not readily appear to have answered the transportability questions for "extent of condition." The assessment team leader had to contact specific evaluators who had to more clearly explain those details that were not contained in the details of the LACEs. In turn, the assessor/reviewer found all the LACEs to be acceptably performed. This assessment identified no Strengths, no Areas for Improvement, and no Noteworthy Items.

The Team found that this assessment should have included more objective evidence and details, such as a listing of the 16 LACEs that were reviewed during the assessment. Also, more details should have been included in the two LACEs where transportability (extent of condition) was not clearly evident leaving no question in one's mind when being independently reviewed by others. The assessor should have been more critical in his ACEs and also could have provided more details in the assessment report by including a list of the 16 LACEs reviewed.

### **2.6.3 Adequacy, Timeliness, and Effectiveness of Improvements in the CAP as a Result of Internal Assessments**

The assessment team noted that internal assessments reduced focus on the CAP program, shifting the focus to be performed by the line organizations. There has been no QA audit of the Davis-Besse CAP program during this review period with the next CAP audit scheduled for September 2008. Assessments did identify an increase in Maintenance generation of CRs for new items found while performing PMs and for identifying lower level items on CRs. Also noted was timeliness of initiation and supervisory screening of CRs and also in tracking self-assessment noteworthy items in the SAP notification process versus the CREST Corrective Action Program.

### **2.6.4 Review of Safety Review Committee Activities**

#### **July 2008 Company Nuclear Review Board (CNRB) Loss Prevention Subcommittee Meeting**

The Team attended the CNRB Loss Prevention Subcommittee Meeting held at Davis-Besse on 7/9/2008. Major items discussed included the following:

- Fleet Oversight Performance Report/Assessment of the QA Program/Performance Indicators
- ECP/ Safety Conscious Work Environment (SCWE)/Safety Culture
- Corrective Action Program
- Self-Assessment Program
- Regulatory Performance
- Security/Fire Protection/Emergency Preparedness Programs

In the area of CAP implementation, the CNRB Subcommittee reviewed the status of CAP backlogs, aging data, applicability of RIS 2006-13, and three significant RCEs. Four ACEs were reviewed, along with six

LACEs. The Subcommittee's assessment of the Oversight organization was that QA is sufficiently critical and line management is accepting of quality findings.

Nineteen Fleet and Davis-Besse station snapshot assessments were submitted to the committee and the adequacy of the Self-Assessment Program was determined to be sufficiently critical and adding value to the station.

The Subcommittee members had representation from each of the stations in the FENOC Fleet and posed challenging questions to the presenters on Performance Indicators and the effectiveness of the CARB. Follow-up was requested on several items for the next CNRB subcommittee meeting.

### **September 2007 Company Nuclear Review Board (CNRB)**

The Team reviewed the 9/14/2007 Meeting Minutes that were approved on 10/24/2007. Major issues highlighted included the following:

- Chemistry continued to be an area that required significant attention. The chemistry areas for improvement (AFIs) identified by WANO reinforce this need. The Board will continue to monitor the responses to the WANO AFIs and other actions during future CNRB meetings.
- Preparations for the upcoming refueling outage have improved from previous outages. This stems, in large measure, from more detailed planning and increased maintenance department engagement. Station personnel generally understand the challenge of completing the final preparations while continuing an effort to meet other 2007 station priorities. However, a specific plan that reconciles competing priorities must be established and clearly communicated to assure final preparations are conducted with sufficient rigor.
- As a result of interviews and document reviews, there were challenges identified in meeting human performance standards. In particular, the Board identified inconsistencies regarding execution of standards both at the worker and supervisory levels. It appears current training has not been fully effective and new training approaches, such as the use of video media, should be considered.
- Management missed an opportunity in setting high standards in an important area by the response to the overpower event that occurred in June 2007. The reactivity performance indicator for June 2007 remained GREEN while the event was classified as a human performance precursor (i.e., near miss) and a level 3 reactivity management event (minor challenge to reactivity management). The Board feels management should have sent a clear message that there is no "minor" overpower situation, and all employees, including computer technicians, need to understand how their activities can potentially affect reactivity.

In the area of CAP implementation, the CNRB subcommittee reviewed one RCE and five ACEs and determined that they were all acceptable. The Subcommittee concluded that the CAP is being implemented effectively at Davis-Besse. There was high participation in the SCWE Survey, positive attitudes are being demonstrated by Davis-Besse staff, and there was increased recognition of Need for Improvement. "Deltas" noted were two long-standing open ECP Concerns and the inconsistency of reports.

The CNRB Subcommittee indicated recognition of the need for increased criticality and intrusiveness in Oversight activities and that there had been an increase in human performance errors. A delta was noted

by the Loss Prevention Subcommittee in regard to having no performance indicators to measure CAP quality and effectiveness.

In addition, the Board recognized the continued progress at Davis-Besse since the previous meeting. Operations continued with relatively few events, overall improvements were noted in outage preparations, and the plan regarding potential M5 fuel issues was considered comprehensive. In addition, the corrective action and self-assessment programs were being implemented effectively.

#### **June 2007 Company Nuclear Review Board (CNRB)**

The Davis-Besse CNRB convened the week of 6/4/2007. For this meeting, the Board reviewed the operational, technical, and safety issues challenging the station. Based on document reviews, interviews, and field observations, the Board concluded that the Davis-Besse Nuclear Power Station continues to operate safely. The Board recognized the accomplishments the station personnel have achieved since the beginning of the year (e.g., safe and event-free operations during the plant maneuvers for the condenser tube repair), the corrective and elective maintenance backlog reduction, the successful NRC emergency plan evaluated exercise, and the NRC inspections. The accomplishments and positive attitude of the station personnel were considered a reflection on the site leadership team. However, the following are the areas that the Board collectively considers the primary issues from this meeting:

- There have been a few events of low safety significance that collectively indicate potential shortfalls in management decision making, questioning attitude, and effectiveness of the CAP. The Board recommended the station review the seismic system operability issue, the high pressure injection discharge pipe voiding, and the emergency diesel generator loose connection issue for commonality to capture organizational learnings.
- The Chemistry department was experiencing a variety of issues. The elevated plant chemistry parameters resulting from the condenser tube leaks appear to have been managed to maintain the chemistry performance index rather than protecting the asset. The tritium plan lacks sufficient detail for scheduling and contingency planning. The department is vulnerable to a repeat Area for Improvement in chemistry fundamentals due to staffing. The Board recommended the station management review these issues to prioritize the actions and to monitor for effectiveness.
- Safe and event-free outage performance comes from detailed preparations and planning. The clearance tagging and work package planning appeared to be progressing well; however, outage preparations may be challenged by upcoming assessments [e.g., component design basis inspection (CDBI), WANO evaluation, and the four Confirmatory Order Independent Assessments], which could divert station personnel focus. The Board was interested in how the competing priorities will be addressed to ensure adequate progress continues for the refueling outage preparation.

The Board noted positive performance for areas of reduction in backlog (corrective and elective maintenance), successful emergency plan graded exercise, successful plant down-power, and various NRC inspections with no findings, all of which reflected on the leadership of Davis-Besse. In addition, several of the Board members noted a positive attitude by Davis-Besse personnel that was present throughout the week the Board was on site.

The report also noted concerns with several items in the Chemistry area (potential shortfalls in management decision making and in outage preparations). Subcommittee minutes also addressed that the CAP is being effectively implemented with specifics related to the backlog reduction plan, and that one root cause and six ACEs evaluated as acceptable.

### **March 2008 Company Nuclear Review Board (CNRB)**

The Davis-Besse CNRB convened on 3/14/2008. For this meeting, the Board reviewed the operational, technical, and safety issues challenging the station based on document reviews, interviews, and field observations. The Board concluded the Davis-Besse Nuclear Power Station continues to operate safely.

The Board recognized Plant performance continued to improve with the most notable example being the final planning and execution of the 15th RFO. Management behaviors during 15 RFO were professional, properly focused on safety, and in keeping with SCWE expectations. This was especially noted when the organization was faced with emerging issues that could have had significant negative impact on safe, effective outage execution. In addition, radiation dose was significantly reduced from previous outages and operations were event-free. With regards to the primary issues identified during the 9/14/2007 CNRB meeting, the Board concluded sufficient progress has been realized in addressing the outage preparation and human performance standards issues. Therefore, these issues would be closed. The Board planned to follow progress on improvements in the Chemistry area, particularly those identified during the WANO visit.

The Board felt Davis-Besse management missed an opportunity in setting high site-wide standards in an important area by the response to the unplanned power change event that occurred in March 2008. The level 3 reactivity event from condenser air intrusion/degraded vacuum was focused solely in operations and operator fundamentals. The Board felt management should have sent a clear message focused on conservative decision making and understanding of potential plant impact from online plant maintenance. In addition, the Board also felt this missed opportunity may be similar to the item identified in the previous 9/14/2007 CNRB meeting.

Two new issues were identified during the 3/14/2008, meeting:

- Operations may be vulnerable to performance issues due to recent organizational changes, shift re-alignment, and evidence of weak alignment on focus and improvement initiatives. Operations should consider increasing the frequency of Shift Manager meetings, conducting shift teambuilding and alignment activities, and/or increasing simulator training during upcoming training cycles to minimize this vulnerability.
- An error-likely situation exists in the Measurement Uncertainty Recovery Power Uprate project due to the multiple project starts and project management changes. Prompt attention is required to assure a complete high quality project is delivered. Joint site/fleet scoping and "challenge" sessions are recommended to ensure project success.

The Board also identified, in the Chemistry area, that four out of five corrective actions associated with the response were past due, and that it would be beneficial to formally notify the assessor regarding new due dates. In one specific area, it was noted the station made a conscious decision to delay implementing the new analytical process for determining equivalent dose iodine because of the recent fuel leak. Although this appears to be an appropriate decision until the leak stabilizes, the Subcommittee recommended utilizing the old analytical process in conjunction with the new process to compare results. The Chemistry Manager indicated this recommendation would be implemented.

In the area of training, the Subcommittee cautioned there are potential challenges within the next two to three years regarding staffing. Davis-Besse station needs to be focused on maintaining the training staff to meet the needs of the future. On a positive note, the Training Manager was aware of the Perry Operations training probation issue/root cause and was already implementing corrective actions at Davis-Besse.

The CNRB Subcommittee reviewed CRs issued as a result of the previous CNRB meeting and found them to be adequately resolved. A “delta” was noted by the Loss Prevention Subcommittee in regards to having no meaningful performance indicators for Oversight Activities.

#### **CR 07-21934, CNRB Action- Inconsistent DBOV CR Initiation rate compared with BVOV & PYOV**

The team performed a review of a CNRB subcommittee concern that the initiation of CRs from the Davis-Besse Oversight (DBOV) organization for the previous year was approximately one half the rate as compared to the Perry Oversight (PYOV) and Beaver Valley Oversight (BVOV) organizations for the same period of time. The CNRB requested DBOV to evaluate this inconsistency and identify the apparent cause. This CR is categorized as an adverse condition requiring a FACE.

The apparent cause for this CR was that DBOV generates CRs at the threshold defined by the CAP, while the Beaver Valley and Perry Oversight organizations generate conditions below the established threshold. A lack of written guidance or expectations for when to initiate CRs beyond the established requirements has lead to inconsistency within Fleet Oversight.

When compared to the other FENOC sites, the initiation rate of CRs generated by DBOV measured as a percentage of the total CRs initiated on a site basis is consistent. This comparison was based on the quantitative inputs of CR issuance documented by the self-assessment performed by Fleet self-assessment FL-SA-07-35.

Written Fleet guidance and expectations were established for when to initiate CRs beyond the established threshold of the CAP during oversight activities (i.e., compliance audits, performance assessments, quality control inspections, and receipt inspections).

The team determined the CR was properly categorized, the problem statement was clear, and the apparent cause and investigation was concise and appropriate. Corrective actions were effective in providing CR initiation expectations. Davis-Besse provided good follow up to the CNRB subcommittee.

#### **2.6.5 Summary**

The Team concluded that Davis-Besse is effectively identifying and resolving CAP issues that are identified during audits and assessments. The Team determined that there is indication that the station’s focus on the CAP has been reduced. For example the Oversight organization did not assign the CAP a performance rating for three quarters in 2007, as documented in the quarterly reports’ Performance Assessment Ratings, due to not assessing the program sufficiently enough to assign a rating. The Team considers the detail, quality, and management support of the self-assessment process to be a significant contributor to achieving excellence at Davis-Besse.

#### **Areas of Strength**

None

#### **Areas in Need of Attention**

The reduction in Oversight (QA) focus on CAP program review and reporting of results in the quarterly Oversight Report “Performance Assessment Ratings” is considered an Area in Need of Attention.

#### **Areas for Improvement**

None

## **Conclusion**

The Team rated the *Effectiveness of Internal Assessment Activities* of the Davis-Besse CAP as EFFECTIVE.

### **2.7 Effectiveness of Corrective Actions from Previous Independent Assessment of the Davis-Besse Corrective Action Program**

The Team reviewed the corrective actions proposed and taken in response to Areas in Need of Attention and Areas for Improvement identified during either the 2005, 2006, or 2007 Independent Assessment of the Davis-Besse CAP. The Team evaluated the corrective actions taken since the 2007 Assessment for strengths, weaknesses, or slow responses. The following are the Team observations for closed CRs developed in response to prior assessments.

#### **2.7.1 Evaluation of Past “Areas in Need of Attention”**

##### **CR 07-29357, COIA-CAP 2007: Equipment Trending Report Issuance**

##### **CR 06-06723, COIA-CAP 2006: Equipment Trending Below Industry Standards**

##### **CR 05-04411, COIA-CAP-2005: Equipment Trending Below Industry Standards**

The above previous assessments had identified that trending of equipment problems across systems was an Area in Need of Improvement/Attention. In response, FENOC developed a business practice NOBP-ER-3916, “Component Health and Trending (CHT) Process,” designed to identify common component problems. The 2007 Team verified the implementation of this process and found the progress adequate, except that the trending program had not yet produced the quarterly reports on component trends. The reports were needed to judge the effectiveness of the program. Therefore, the absence of completed quarterly trend reports was an Area in Need of Attention.

On 8/9/2007, Davis-Besse initiated CR 07-29357, Equipment Trending Report Issuance, in response to the 2007 COIA finding. By that time, the first quarterly report had been developed. The CR was classified as closed because adequate program implementation was evidenced by CR 07-27715, Adverse Component and Trend – Motors 2Q07.

The 2008 Team verified that other quarterly reports and trends have been promulgated since 2007. The Team’s findings are detailed in Section 2.4 of this report. Although minor weaknesses have been identified by Davis-Besse for resolution, the Team considered the satisfactory implementation of the Equipment Trending Process to date sufficient to close this issue.

##### **CR 07-29360, COIA-CAP 2007: Tracking Significant CAs Outside the CAP Process**

##### **CR 06-09223, COIA-CAP 2006: Closing CAQ CRs to Notifications**

The 2006 Team found examples of CR corrective actions that had been improperly closed to SAP work notifications. Davis-Besse implemented new CR corrective actions to track these actions and performed an extent of condition assessment to determine whether there was a broader issue. A small number of other action closures were found and remediated, but no systemic deficiency was found.

The 2007 Team also found two examples of CR corrective actions improperly closed to SAP work items. This continuing issue was noted as an Area in Need of Attention. On 8/9/2007, Davis-Besse initiated CR 07-29360, Tracking Significant Corrective Actions Outside the CAP Process, in response to the COIA

finding. This CR was classified as closed because one corrective action was remediated during the assessment and the other was appropriately cancelled. No further action was taken.

The 2008 Team concluded that Davis-Besse accepts an occasional improper closure. As a check, Performance Improvement CR and SAP screeners look out for improper closures and remediate those identified. The 2008 Team identified no other CR corrective actions closed to high priority SAP Work Orders. One issue detailed in Section 2.3 of this report involved misleading corrective action wording and a corrective action closure to a proposed modification. Davis-Besse promptly wrote a CR to resolve this issue. The Team determined that satisfactory progress has been made to close this issue.

#### **CR 07-29356, COIA-CAP-2007: Initiating CAs to Perform Additional Cause Analysis**

The 2007 Team found two examples where elements of cause analysis were transferred to corrective actions to be completed after CARB approval of the cause evaluation. There was no mechanism to verify that the subsequent analysis did not affect the approved evaluation. The examples involved the conduct of training gap analyses and chemical and hardware failure analyses for the master trip solenoid valve (MTSV). On 8/9/2007, Davis-Besse initiated CR 07-29356, COIA-CAP-2007: Initiating CAs to Perform Additional Cause Analysis, in response to the COIA finding. This CR was classified as closed because the gap analysis concern was already corrected by a policy change to require training coverage during cause evaluations; and the MTSV concern was remediated by CR 07-23297, CR 06-02588 Continued Investigation Not Returned to CARB. The Performance Improvement Supervisor also discussed with CARB the need for follow-up on analysis elements assigned after CARB review.

The 2008 Team reviewed these actions and also found examples where elements of analysis needed after CARB review were specifically tagged with action for CARB follow-up. In addition, the Team witnessed CARB activities that evidenced a continuing sensitivity and follow-through on this concern. The Team concluded that this issue is closed.

#### **CR 07-29358, COIA-CAP-2007: Extension Documentation For CAs Tracked By PRI 600 Work Orders**

The 2007 Team identified several instances where the justification of extending CR corrective actions was simply the phrase, "This is a PRI 600 work order." The extension lacked detail on the risk incurred by the extension and the need for compensatory actions until the corrective action is completed. On 8/9/2007, Davis-Besse initiated CR 07-29358, COIA-CAP-2007: Extension Documentation For corrective actions Tracked by PRI 600 Work Orders, in response to the COIA finding. The CR fix evaluation confirmed the incorrect behavior exhibited by the requester and approver of these extensions. A written communication was delivered to all site personnel to reinforce the expectations for proper documentation of corrective action extensions.

The 2008 Team found no corrective action extensions with the simple PRI 600 work order rationale. The Team considered this issue closed.

### **2.7.2 Summary**

The Assessment Team reviewed the actions taken in response to open Areas in Need of Attention from prior assessments and closed all of the open issues.

#### **Areas of Strength**

None

**Areas in Need of Attention**

None

**Areas for Improvement**

None

**Conclusion**

The Team rated the *Effectiveness of the Corrective Actions from Previous Independent Assessment of the Davis-Besse Corrective Action Program* as EFFECTIVE.

## 3.0 METHODOLOGY

### 3.1 Assessment Methodology

The assessment methodology included the following:

- Observing activities;
- Interviewing personnel;
- Reviewing documentation;
- Evaluating trend analysis;
- Reviewing procedures, instructions, and programs; and
- Comparing actual performance levels with pre-established ones.

The Team gathered data on the implementation of the Corrective Action Program (CAP) through document reviews, observations, and interviews. The Team observed several Management Alignment and Ownership Meetings (MAOMs) and two Corrective Action Review Board (CARB) meetings.

The Team reviewed Condition Reports (CRs), apparent cause evaluations (ACEs), root cause evaluations (RCEs), trend reports, self-assessments, and other assessment reports. The Team also interviewed CR initiators, evaluators, and management personnel. The data obtained was evaluated in order to identify Areas of Strength, Areas in Need of Attention, and Areas for Improvement.

The following general standards of acceptable corrective actions were applied to the assessment of the Davis-Besse CAP implementation:

- The problem is identified in a timely manner commensurate with its significance and ease of discovery.
- Identification of the problem is accurate and complete and includes consideration of the generic implications and possible previous occurrences.
- The problem is properly prioritized for resolution commensurate with its safety significance.
- The root causes of the problem are identified and corrective actions are appropriately focused to address the causes and to prevent recurrence of the problem.
- Corrective actions are completed in a timely manner.

Areas of Strength, Areas in Need of Attention, and Areas for Improvement were based on the definitions in DBBP-VP-0009, "Management Plan for Confirmatory Order Independent Assessments," using the following terminology.

#### Area of Strength

This term is used to characterize demonstrated performance in a program or process element within an area being assessed that is exceptionally effective in achieving its desired results, demonstrates a high degree of attention to detail, and is significant in obtaining desired results. An Area of Strength is a program, process, or activity of such a high quality that it could serve as an example for other similar elements.

### **Area in Need of Attention**

This term is used to identify a performance, program, or process element that is sufficient to meet its basic intent. However, management attention is required to achieve full effectiveness and consistency. Areas in Need of Attention are not normally identified or addressed in action plans submitted to the U.S. Nuclear Regulatory Commission (NRC), but are brought to management attention for consideration and possible entry into the Davis-Besse CAP.

### **Area for Improvement**

This term is used to characterize an identified performance, program, or process element that requires improvement to obtain the desired results in a consistent and effective manner. All Areas for Improvement identified in the Assessment Report are expected to be addressed by the Action Plan submitted to the NRC.

## **3.2 Assessment Categories**

Based on the Team's overall assessment, each area evaluated was given a rating of the area's overall effectiveness. The categories used to identify the overall effectiveness are defined in DBBP-VP-0009 and below.

### **HIGHLY EFFECTIVE**

Assessment results identified no Areas for Improvement and no or few Areas in Need of Attention. Performance, programs, and processes are more than sufficient to obtain the desired results with consistency and effectiveness.

### **EFFECTIVE**

Assessment results identified *no or a few* Areas for Improvement and *one or several* Areas in Need of Attention. Performance, programs, and processes are sufficient to obtain the desired results with consistency and effectiveness. (*edited version*)

### **MARGINALLY EFFECTIVE**

Assessment results identified more than several Areas for Improvement and several or more Areas in Need of Attention. The basic intent of the program or process is achieved; however, the performance, program, or process is challenged to obtain the desired results with consistency and effectiveness. Prompt management action is required.

### **NOT EFFECTIVE**

Assessment results identified significant shortcomings such that the basic intent of the program or process is not being achieved. Items identified as NOT EFFECTIVE require immediate management action.

## 4.0 REFERENCES

### 4.1 Persons Contacted During the Assessment

The following is the list of individuals contacted during the 2008 Independent Assessment of the Corrective Action Program Implementation at Davis-Besse Nuclear Power Station between 7/7/2008 and 7/18/2008.

Name	Position
<b>Fleet, Supervision, Oversight, Training, and Security</b>	
Barry Allen	Site Vice President
Vito Kaminskas	Director Site Operations
Clark Price	Director, Performance Improvement
George Eades	Electrical and I&C Training Instructor
Rick Jarosi	Employee Concerns Program Coordinator
Randy Rossomme	Fleet Manager, Corrective Action Program
Daniel Philipps	Fleet – Maintenance Program Manager
Gary Foster	Fleet – Component Engineer
John Fleitz	Davis-Besse Human Performance Advocate
Doug Andrews	Oversight, Compliance Lead Auditor
Matt Lewczyinski	Oversight, Staff Nuclear Specialist
Bruce Zibung	Oversight, Performance Assessor
David Lang	Oversight, Performance Assessor
Mark Levering	Oversight, Staff Nuclear Specialist
Michael Rohde	Security Officer
<b>Site Performance Improvement</b>	
Brian Hennessy	Supervisor, Performance Improvement
Charles Ackerman	Performance Improvement Staff
Kevin Browning	Performance Improvement Staff
John J. Johnson	Performance Improvement Staff
<b>Engineering &amp; Chemistry</b>	
Donald Moul	Director, Site Engineering
John Cunnings	Supervisor, Plant Engineering
Jason Stelmaszak	System Engineer

<b>Name</b>	<b>Position</b>
Scott Plymale	Manager, Plant Engineering
Steve Henry	Sr. Nuclear Specialist
Dave Baker	Sr. Consultant, Davis-Besse Site Projects
Eric Grindahl	System Engineer
Ken Byrd	Manager, Design Engineering
Jessica Kemp	Design Engineer
Frank Zurvalec	Staff Nuclear Engineer
Dennis Schreiner	Technical Services Engineer
Pat McCloskey	Manager, Chemistry
Rebecca Maylish	Chemistry Technician
Katharine Momenee	Chemistry Staff
<b>Maintenance</b>	
Brian Boles	Director Maintenance
John Dominy	Maintenance Manager
Mark Roelant	Maintenance Superintendent
Jane Mallernee	Maintenance Staff
Adam Justice	I&C Apprentice
<b>Operations &amp; Radiation Protection</b>	
Dave Imlay	Operations Manager
Dave Witt	Operator
Mark Swain	Equipment Operator
David Slobodzian	Equipment Operator
Rhonda Hermes	Radiation Protection. ALARA Staff
Jay Hasselbach	Radiation Protection, Radiation Protection Technician

## 4.2 Condition Reports

The following is a list of the Condition Reports (CRs) reviewed during the 2008 Independent Assessment of the Corrective Action Program Implementation at Davis-Besse Nuclear Power Station.

Report Number	Title
05-00796	Electric Fire Pump ABT Response to Electrical Transients
05-03202	Operations – Zone 3 Tour Notes
05-04411	COIA-CAP-2005: Equipment Trending Below Industry Standards
05-05278	Fuel Integrity Monitoring Did Not Identify Cycle 14 Fuel Defects
06-00207	Wrong Load Value Used in Calculation Addendum
06-00583	Further Evaluation Actions Regarding EDG 2 Tapping Noise on 1/13/2006
06-6990	Misc. DSL Generator Auto Transfer Switch Clearance Unexpected Results
06-8128	FAC Program Deficiency Evaluation
06-8338	ALARA Program – NRC Identified Green Finding
07-18074	HPI Train 1 Discharge Piping – Potential Air Intrusion
07-19158	Caldon System Trouble Alarm 10-4-A
07-21862	Plant Computer Failure
07-21934	CNRB Action- Inconsistent DBOV CR Initiation rate compared with BVOV & PYOV
07-22129	Disparity in CR Initiation Rate Between Fleet Sites
07-23306	COIA-CAP 2007: CARB Chairman Delegation to Review Follow-up Action Items
07-23774	COIA-CAP-2007: CA 07-15971-2 Closed To 500 Priority Notification That Was Reject
07-24460	Door 201A Failure to Latch
07-24664	SAC 1 Failed to Load
07-24954	NRC RV Head Drop Inspection Comments/Concerns with Calc. C-CSS-062.01-024
07-25026	Adverse Trend in LEFM Meter 1 Path 2 Reject Rate
07-25074	Caldon System Trouble Alarm – 10-4-A
07-25133	Errors with Analysis and Reporting of RCS Stripped Gas
07-25151	Tritium Activity Confirmed in Previously Sampled Groundwater Monitoring Wells
07-25993	Inadequate SW Flow through CCW Heat Exchanger #1
07-26233	Incorrectly Labeled Oil Received From the Warehouse
07-26911	Scaffold Wrench Dropped in the Transfer Canal
07-27250	Potential Deficiency in Processing of Regulatory Issue Summaries
07-27355	CNRB Concern – Condition Report 07-18003 Root Cause Depth
07-27630	Analysis Deficiency for Internals Handling Adapters
07-27715	Adverse Component Health Trend – Motors – 2Q07
07-29358	COIA-CAP-2007 Extension Documentation for CAS Tracked by PRI 600 Work Orders
07-29357	COIA-CAP-2007 Equipment Trending Report Issuance

Report Number	Title
07-29358	COIA-CAP-2007 Extension Documentation For CAs Tracked By PRI 600 Work Orders
07-29360	COIA-CAP-2007 Tracking Significant Corrective Actions Outside The Cap Process
07-29388	Additional Actions from Effectiveness Review of CR 06-00207
07-29742	NRC Concerns With CR 07-29188
07-29893	COIA-ENG-2007, ANA #3, System Health Activities: Plant Computer, 480VAC Rad Mon
07-30257	Corrective Action to Increase Torque on Packing for HP31 Resulted in Same Value
07-30400	Component Health Status – Motors – 3Q07
07-30458	Non-essential Inverter YVA & YVB Diode Failure Trend
07-32112	Pressurizer Level Decrease While Placing DH Train 1 in Standby
08-32521	Pressure Boundary Leak Found During Decay Heat Drop Line Weld Overlay
08-32755	RCM5328 CREVS Train 2 Pulley Failure
08-33026	Broken Tubing on Train 2 CREVS Causes Loss of Refrigerant and Compressor Trip
08-33163	Plant Computer MUX Power Supply Failure
08-33531	CREVS Has Exceeded its Maintenance Rule Performance Criteria
08-33818	MU38 Failed to Travel to its Fail Position During Operational Testing
08-33974	Vale Testing of MU38 Per DB-PF-03386
08-34050	Gas Void Detected at Core Flood Tank 1-1 Discharge Pipe
08-34065	While Performing DB-SC-03022 Breaker 34562 Closed And Immediately Reopened
08-34173	CREVS Train 1 Low Refrigerant Charge
08-34323	Oil Leakage from Main Feed Pump #1 Speed Increaser
08-34786	High Vibrations on Generator Bearing 7
08-34807	Delay in Performance of RCP Seal Leakage Test DB-SP-03356
08-35250	Infrared Inspections Have Identified Repetitive Concerns Noted with BE6103
08-35417	NRC NCV: Internals Handling Adapter Calc Did Not Consider Fracture Toughness
08-35591	Previous Safety Concern CR Closed Without Adequately Addressing Issue
08-35843	NRC ID: Ind AP Assess Lacked HU and Org Review
08-36528	Probable FW Heater Tube Leak in Train 1 High Pressure FW Heaters
08-36573	Inadvertent Addition of Station Air into the Condenser Causing Degraded Vacuum
08-36633	INPO Chemistry Assist: Improve Radiological And Safety Laboratory Practices
08-36684	CREVS 1 Compressor Trip During Monthly Test DB-SS-03041
08-36881	DB-OP-06011, High Pressure Injection System Procedure, Fill/Vent Procedure Deficit
08-37093	Variability in Reactor Coolant Cobalt-58 Measurements
08-37292	Recent Trend in Human Performance Not Meeting Expectations
08-37319	Electrical Near Miss While Installing Fence Post

Report Number	Title
08-37644	Potential MDFP and Auxiliary Feedwater Fill and Vent Deficiencies
08-37825	#4 Circ Pump Cooler Flow Low
08-38135	Surveillance Requirements For Source Range Nuclear Instruments
08-38217	Purification Demin 1-1 Exhausted Earlier Than Expected for Lithium Removal
08-38321	Use of Wrong RWP
08-38871	Main Steam Room Temperatures above 110 °F
08-39704	RE4597BB Motor Thermal Overload at the Skid Tripped After Sample Pump Shutdown
08-39741	Internal Flooding When Service Water Pump 1 Strainer Placed in Service
08-40150	DB-OP-06012, Low Pressure Injection System Procedure, Fill/Vent Procedure Deficit
08-40242	B-SA-08-039 Licensed Operator Training Instructors Not Fully Meeting ACAD 97-014 Requirements
08-40255	Chemistry Laboratory Deficiencies IAW NOP-OP-3100, Chemical Hygiene Plan
08-40879	Unexpected Drop in CREVS Suction Pressure
08-40906	Pipe Support Failure Due to Vibration
08-41216	SAC 2 Tripped
08-41699	Cross-cutting Theme for Human Performance Aspect H.2(C), Documentation
08-41860	DB-PA-08-02: System Health Reports Do Not Accurately Reflect Requirements
08-42734	Hole in Drain Cleanout Cover
08-42761	MTSV "A" Failed to Reset Again During Testing
08-42762	Adverse Trending for Flush Flow Rate to RCP 1-1 and RCP 2-1
08-42775	Compressor Trip During Performance of Control Room EVS Train #1 Monthly Test
08-42782	Planned Service Water Strainer 2 Work Removed from T8 Schedule
08-42783	Fuse Blown in C 5601 Due to Shorting of Wires While Relanding TSL5706A
08-42785	Water Draining from 02 Startup Transformer Deluge System (FP157)
08-42795	RE 4686 Has No Flow
08-42799	OJT/TPE Action Codes Not Circled in ONL 902 Qual Manual
08-42825	PI179 Found Out of Tolerance
08-42828	BACC, MU 239, MU 241, and MU 241A Have Boric Acid Accumulation
08-42839	Control and Account of Keys Not Following NOBP-LP-1104
08-42843	Roofing Installation – Hot Asphalt Sets Off LV Switchgear Fire Alarm
08-42844	C85 Possible Rework
08-42850	Sump Pump Does Not Exist at MH3012
08-42854	DB-MC58 Open Motor Windings
08-42871	Aux 11 XFMR Danger (1-2-F) Due to Invalid Loss of Normal Power Supply Alarm
08-42894	16 RFO Milestone 10 – Freeze Outage Scope, Closure Criteria Not Met

Report Number	Title
08-42923	Red ER Index Window for System Health Improvement Effectiveness
08-42937	DH1B Cannot Be Set Up to the Current Data Package Settings
08-42957	DH Pump 1 Vibration in Alert Range
08-42973	Training Start Time Delayed
08-42981	Overload Blocks Fail Pre-test
08-42994	Aux Bldg Roof Replacement – Adequacy of Securing Roofing Material
08-42995	BACC: Boric Acid Leak on 1057C
08-43023	NRC MOD/50.59: Performance Deficiency with CR 06-02521 Investigation
08-43024	MTSV A Failed to Reset Immediately During 3 Attempts (DB-SS-04159)
08-43028	Studs on CWMT Pump 1 Backing Plate Not Long Enough to Bolt the Seal on Properly
08-43029	Counties Sound Sirens
08-43031	Aux 11 XFR Loss of Normal Power Supply Alarms
08-43035	NRC MOD/50.59 – Adequacy of Structural Steel Floor Beam
08-43037	BACC: Boric Acid Leak on DH164B Pipe Cap
08-43038	Chemical Control Label Missing on Loctite 580 in EDG-1 Room (QC Label Attached)
08-43042	Elevated Particle Counts in Oil of Bearing Reservoirs
08-43043	Less than Adequate Job Preps for CV2002B in Electrical Maintenance
08-43044	Trending – FT-3682 String Out of Tolerance
08-43046	COIA-CAP-2008 BACC on Decay Heat Pump 2 Not Being Tracked
08-43049	BACC – Boric Acid Found on #2 SFP Pump Mechanical Seal Leakoff Plug
08-43053	Damaged Cable Delays Work on DH1B
08-43055	BACC – Boric Acid Found on #1 HPI Pump Mechanical Seal
08-43057	BACC – Boric Acid Found on #1 Decay Heat Pump Mechanical Seals
08-43061	FW/5-7-3 Found Out of Tolerance
08-43062	CV2002B Will Not Stay in Hand
08-43064	FW 5-7-13 found Out of Tolerance
08-43065	UL 4-1-1 Found Out of Tolerance
08-43069	Maintenance Personnel Observed Not Wearing Gloves
08-43070	CNRB Work Management Subcommittee Concerns Regarding FME
08-43087	Missing Vent Valve on CTMU Pump Strainer
08-43089	BA Pump 2 Failed to Start
08-43080	COAI-CAP-2008 Corrective Action Not Developed for Identified Causes
08-43323	No CR Existed for DH Pump 2 Mechanical Seal Leakage
09-40622	Main Steam Line Room #2 Roof Exhaust Fan is Degraded

### 4.3 Procedures

The following is a list of the procedures reviewed and used during the 2008 Independent Assessment of the Corrective Action Program Implementation at Davis-Besse Nuclear Power Station.

Procedure Number	Procedure Name
DBBP-HU-0001	Davis-Besse Human Performance Team Charter
DBBP-VP-0009	Management Plan for Confirmatory Order Independent Assessments
NOBP-ER-3002	Plant Health Committee
NOBP-ER-3009	FENOC Plant Health Report Program
NOBP-ER-3900	Equipment Reliability Common Definitions and Structure
NOBP-ER-3901	Components Classification ER Workbench Module 1
NOBP-ER-3902	Component Template Development ER Workbench Module 2
NOBP-ER-3903	Component Template Implementation ER Workbench Module 3
NOBP-ER-3916	Component Health and Trending (CHT) Process
NOBP-LP-2001	FENOC Self-Assessment/Benchmarking Practice
NOBP-LP-2007	Condition Report Process Effectiveness Review
NOBP-LP-2008	FENOC Corrective Action Review Board
NOBP-LP-2010	CREST Trending Codes
NOBP-LP-2011	FENOC Cause Analysis
NOBP-LP-2018	Integrated Performance Assessment/Trending
NOBP-LP-2601	Human Performance Program
NOBP-LP-2602	Human Performance Success Clocks
NOP-ER-1001	Continuous Equipment Performance Improvement
NOP-ER-3004	FENOC Maintenance Rule Program
NOP-LP-2001	Corrective Action Program
NOP-LP-2100	Operating Experience Program
NOP-OP-1009	Immediate and Prompt Operability Determination
NORM-ER-3507	Fleet template for HPFW Heaters
NORM-LP-2002	Performance Assessment/Improvement Methods
NRC IP 40500	Effectiveness of Licensee Process to Identify, Resolve, and Prevent Problems
NRC IP 71152	Identification and Resolution of Problems

#### 4.4 Audits and Assessment Reports Reviewed

The following audits, self-assessments, and reports were reviewed by the Team during the completion of this report.

Number	Audits and Assessments
	Davis-Besse Plant Health Report (4 <sup>th</sup> Quarter 2007)
	Davis-Besse Nuclear Power Station Periodic Maintenance Effectiveness Assessment Report for Cycle 14 (March 2004 – April 2006)
DB-PA-07-03	Davis-Besse Fleet Oversight Quarterly Performance Report – 3 <sup>rd</sup> Qtr 2007
DB-PA-07-04	Davis-Besse Fleet Oversight Quarterly Performance Report – 4 <sup>th</sup> Qtr 2007
DB-PA-08-01	Davis-Besse Fleet Oversight Quarterly Performance Report – 1 <sup>st</sup> Qtr 2008
DB-SA-07-054	Davis-Besse Integrated Performance Assessment: Maintenance (1/1/2007 – 6/30/2007)
DB-SA-07-055	Davis-Besse Integrated Performance Assessment: Operations (1/1/2007 – 6/30/2007)
DB-SA-07-062	Davis-Besse Site Roll-Up (1st half of 2007) Integrated Performance Assessment (IPA)
DB-SA-08-0008	Davis-Besse Integrated Performance Assessment: Maintenance (7/1/2007 – 12/28/2007)
DB-SA-08-009 Rev 1	Davis-Besse Integrated Performance Assessment: Operations (7/1/2007 – 12/31/2007)
DB-SA-08-011 Rev 1	Davis-Besse Integrated Performance Assessment: Performance Improvement Unit (CAP) (7/1/2007 – 12/31/2007)
DB-SA-08-016 Rev 1	Davis-Besse Integrated Performance Assessment: DBRC Compliance Unit (7/1/2007 – 12/21/2007)
DB-SA-08-023	Davis-Besse Site Roll-Up Integrated Performance Assessment (7/1/2007 – 12/31/2007)
DB-SA-07-061	Integrated Performance Assessment for Regulatory Compliance (DBRC) Section & Performance Improvement Unit (PIU)
DB-SA-08-027	Review of Outage Limited ACEs
DB-SA-08-049	Condition Report Initiation (CA 07-26489-4)
DB-C-06-03	Davis-Besse Fleet Oversight Assessment Report (Reconciliation)
FL-SA-07-071	FENOC Integrated Performance Assessment Snapshot Assessment (January 2007 – July 2007)
September 2007	Company Nuclear Review Board (CNRB)
June 2007	Company Nuclear Review Board (CNRB)
March 2008	Company Nuclear Review Board (CNRB)
May 2008	Davis-Besse Nuclear Power Station Monthly Performance Report (May 2008)
May 2, 2008	Davis-Besse Cognitive Trend Report : Plant Engineering – Plant and Reliability Engineering (12/29/01 – 3/31/2008)
June 2, 2008	Davis-Besse Nuclear Power Station Corrective Action Review Board Meeting Minutes (6/2/2008)