November 29, 2002

Mr. Lew Myers
Chief Operating Officer
FirstEnergy Nuclear Operating Company
Davis-Besse Nuclear Power Station
5501 North State Route 2
Oak Harbor, OH 43449-9760

SUBJECT: DAVIS-BESSE NUCLEAR POWER STATION
NRC SPECIAL INSPECTION -BORIC ACID CORROSION EXTENT OF CONDITION - REPORT NO. 50-346/02-12(DRS)

Dear Mr. Myers:

On October 24, 2002, the NRC completed a special inspection at your Davis-Besse Nuclear Power Station. This inspection reviewed your actions to resolve Restart Checklist Item No. 2.c, associated with the adequacy of safety significant structures, systems and components located inside of containment. Specifically, this inspection focused on review of a sample of activities as described in the “Davis-Besse Containment Health Assurance Plan.” This plan described your activities to identify, evaluate and disposition the extent of condition throughout the reactor coolant system and containment structures systems and components relative to the nozzle cracking and boric acid corrosion mechanisms that occurred on the reactor pressure vessel head (reference NRC Inspection Report 50-346/02-03(DRS)). Our review of this plan included evaluation of your staff’s inspection methods, control of inspection boundaries, resolution of obstructed examinations, and control of data sheets/video records. The enclosed report presents the results of our review.

Based on our inspection, we have concluded that your staff has implemented appropriate corrective actions to address the lack of inspection quality and thoroughness associated with implementation of your original “Containment Boric Acid Extent of Condition Plan” (reference NRC Inspection Report 50-346/02-09(DRS). Your inspection staff were appropriately trained, equipped with adequate equipment/tools, and followed procedures with adequate quality standards and guidance. The net result was that boric acid and corrosion deposits observed by the NRC inspectors on components (e.g. reactor vessel, hot-leg dissimilar metal welds, and electrical components) within containment were in each case appropriately identified and documented by your staff. Therefore, we concluded that the “Davis-Besse Containment Health Assurance Plan” was effectively implemented.

The inspectors identified three unresolved items associated with corrective actions on components potentially affected by boric acid corrosion. These unresolved items are associated with your corrective actions for boric acid corrosion of electrical conduit, the reactor vessel, and the containment air coolers. These issues were under review by your staff to determine the scope and significance of each issue at the conclusion of this inspection. Additionally, your staff had completed apparent cause determinations with designated corrective actions for only a small number of the components potentially affected by boric acid corrosion. For these reasons, we were not able to reach a general conclusion on the completeness or technical adequacy of your corrective actions for structures, systems, and components affected by boric acid corrosion. Therefore, Restart Checklist Item No. 2.c will remain open pending additional NRC reviews in this area.

In accordance with 10 CFR Part 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA/

John A. Grobe, Chairman
Davis-Besse Oversight Panel

Docket No. 50-346
License No. NPF-3

Enclosure: NRC Special Inspection Report
No. 50-346/02-12(DRS)

cc w/encl:
B. Saunders, President - FENOC
Plant Manager
Manager - Regulatory Affairs
M. O'Reilly, FirstEnergy
Ohio State Liaison Officer
R. Owen, Ohio Department of Health
Public Utilities Commission of Ohio
President, Board of County Commissioners
Of Lucas County
President, Ottawa County Board of Commissioners
D. Lochbaum, Union of Concerned Scientists

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U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket No:	50-346
License No:	NPF-3
Report No:	50-346/02-12(DRS)
Licensee:	FirstEnergy Nuclear Operating Company
Facility:	Davis-Besse Nuclear Power Station
Location:	5501 North State Route 2 Oak Harbor, OH 43449
Dates:	August 1, 2002 through October 24, 2002.
Inspectors:	M. Holmberg, Reactor Inspector, O. Mazonni, NRC Contractor
Approved by:	David Hills, Chief Mechanical Engineering Branch Division of Reactor Safety

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SUMMARY OF FINDINGS

IR 05000346-02-12; FirstEnergy Nuclear Operating Company; on 08/01-10/24/02, Davis-Besse Nuclear Power Station. Special Inspection.

This report covers a 3-month special inspection of licensee activities associated with identifying and evaluating the effects of reactor coolant leakage and boric acid corrosion of components and systems within containment. This inspection was conducted by an NRC contractor and an inspector based in the NRC Region III Office. The significance of most findings is indicated by their color (Green, White, Yellow, Red) using Inspection Manual Chapter 0609, "Significance Determination Process" (SDP). Findings for which the SDP does not apply may be "Green" or be assigned a severity level after USNRC management review. The USNRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 3, dated July 2000.

A. <u>Inspection Findings</u>

No findings of significance were identified.

B. <u>Licensee-Identified Findings</u>

No findings of significance were identified.

REPORT DETAILS

Background and Event Overview

On March 6, 2002, Davis-Besse personnel notified the NRC of degradation (corrosion) of the reactor vessel head material adjacent to a control rod drive mechanism (CRDM) nozzle. This condition was caused by coolant leakage and boric acid corrosion of the head material induced by an undetected crack in the adjacent CRDM nozzle. The degraded area covered in excess of 20 square inches where the low-alloy structural steel was corroded away, leaving the thin stainless steel cladding layer. This condition represented a loss of the reactor vessel's pressure retaining design function, since the cladding was not considered as pressure boundary material in the structural design of the reactor pressure vessel. While the cladding did provide a pressure retaining capability during reactor operations, the identified degradation represented an unacceptable reduction in the margin of safety of one of the three principal fission product barriers at the Davis-Besse Nuclear Power Station (reference NRC report 50-346/02-03(DRS)).

As a corrective action for the vessel head degradation, the licensee implemented the "Davis-Besse Containment Health Assurance Plan" (DBCHAP). This plan described activities to evaluate and disposition the extent of condition throughout the reactor coolant system and containment structures, systems, and components (SSCs) relative to the degradation mechanisms that occurred on the reactor pressure vessel head. The NRC inspectors reviewed the activities as described in the DBCHAP. Given the high public interest in this subject area at Davis Besse, and therefore the need to clearly communicate the rationale for NRC staff conclusions regarding the effectiveness of licensee extent of condition inspections, this report documents the inspectors' observations.

4. OTHER ACTIVITIES

4OA3 Event Follow up (93812)

.1 Containment Health Assurance Plan Charter

a. Inspection Scope

The NRC inspectors reviewed the DBCHAP to evaluate the adequacy of the plan charter and scope of SSCs included under the licensee's plan.

b. Observations

The purpose of the DBCHAP included performance of inspections, and evaluation of containment SSCs prior to restart to ensure that the condition of the containment supported safe and reliable operation. This plan was focused on the extent of cracking of alloy 600 welds in the Reactor Coolant System (RCS) and any damage that may have resulted from boric acid leakage and dispersion in containment. The licensee defined three specific terms relative to the scope of SSCs inspected within containment as follows:

- Sources: Components containing borated water that were considered likely leak locations. The licensee further subdivided sources into three groups; mechanical joints (e.g., valve packing, bolted flanged connections), alloy 600 components/welds, and instrument tubing. The licensee conducted inspection of sources to assure that evidence of RCS leakage from any source was properly identified and evaluated.

- Targets: Components within the RCS that utilize materials susceptible to boric acid corrosion (carbon and low alloy steels) as part of the pressure boundary. The licensee conducted inspection of targets to assure that no undetected degradation of the RCS pressure boundary existed.

- Miscellaneous: Non-RCS pressure boundary SSCs, utilizing materials susceptible to boric acid corrosion, but are not part of the RCS. The licensee conducted inspection of miscellaneous SSCs to verify that boric acid corrosion had not adversely impacted component functions.

In the DBCHAP, the licensee also identified action plans to resolve issues in seven focus areas within containment: alloy 600 components and welds (alloy 82/182) within the RCS, containment emergency sump material condition and design basis/ decay heat valve pit, containment vessel liner inspections, impact of distributed boric acid on environmentally qualified equipment, refueling canal leakage, containment air cooler degradation, and containment coatings. The NRC inspectors reviewed the proposed actions for identification of issues under six of these plans. These plans contained a problem description, source documents, corrective actions with due dates and documentation requirements for completion. The scope of these engineering plans appeared to be sufficiently broad to assess the documented problem description. The evaluations and corrective actions from these plans were required to be reviewed by the licensee's Engineering Assessment Board. This board was chartered to perform in-process reviews geared towards stimulating ideas, promoting a questioning attitude, and assisting in improving overall product quality.

The NRC inspectors considered the charter and scope of the DBCHAP to be sufficiently comprehensive to identify the potentially degraded safety-related components affected by boric acid corrosion within containment. However, the licensee's Quality Assurance (QA) staff identified in condition report (CR) 02-06296, that the "Environmental Qualified Equipment Action Plan" identified in the DBCHAP did not address the environmental qualification aspects of the non-safety related motors within containment (e.g., reactor coolant pump, control rod drive ventilation fan, or sump pump motors).

c. Findings

No findings of significance were identified.

.2 Implementation of the Davis-Besse Containment Health Assurance Plan

a. Inspection Scope

In order to evaluate the implementation of the DBCHAP, the NRC inspectors reviewed inspection methods (lighting, visual aides, access), boundaries of inspections, turnover of partial inspections, resolution of obstructions to complete examinations, and control of data sheets and video records generated. Further, the NRC inspectors performed a direct visual examination of the following components/ areas within containment to compare with licensee identified corrosion/boric acid deposits:

Source components (Dissimilar metal welds)

- Nine dissimilar metal welds at pipe penetrations to the RCS hot leg in the West D-ring (component serial numbers HL1-1, HL1-2, HL1-3, HL1-4, HL1-5, HL1-6, HL1-7, HL1-8, and HL1-9).
- Incore instrument tube penetrations at the bottom head of the reactor vessel.

Targets

- Lower areas of the reactor vessel under the insulation.
- Containment vessel penetrations which included feedwater piping penetrations, electrical penetrations and spare/unused penetrations at an elevation of 585 feet in containment.

Miscellaneous

- Cable trays under service water piping systems at an elevation of 565 feet in containment.
- Structural and piping components in areas 3, 4 and 5 at an elevation of 585 feet in containment.

Additionally, the NRC inspectors reviewed personnel certifications and training records and attended training for licensee staff that conducted inspections of SSCs within containment.

b. Observations

b.1 Resolution of Previous NRC Findings

The NRC had previously identified (reference NRC report 50-346/2002-009) two findings and several observations associated with the implementation of the licensee's "Containment Boric Acid Extent of Condition Plan." Based on these findings and observations, the NRC concluded that the "Containment Boric Acid Extent of Condition Plan" was not effectively implemented in all respects. In response to these findings and observations, the licensee revised inspection plans and procedures, re-trained and re-certified inspection personnel and implemented corrective actions to repeat these inspections under the DBCHAP. The NRC inspectors documented the licensee's resolution to these findings in the following report Sections.

b.1.1 Inspection Plan Quality

The NRC had previously identified a finding (Green NCV 50-346/02-09-01) associated with the use of plans used to control the containment area extent of condition inspections, that lacked acceptance criteria and requirements to adhere to the plan. As a corrective action for this issue, the licensee issued three procedures (EN-DP-01500, "Reactor Vessel Inspection Procedure;“ EN-DP-01501, “Inspection of RCS Alloy 600 Components/Welds, Threaded/Bolted Connections and Targets;” and EN-DP 01502, “Containment Area Inspections”) to control the inspection activities inside containment. These procedures contained appropriate instructions and acceptance criteria, and were classified as safety-related.

The NRC had previously identified observations associated with lack of inspection quality and thoroughness. These observations included inconsistent methods to track completion of inspected components, lack of demonstrated visual inspection quality requirements, and failure to identify corrosion/boric acid deposits on components. The licensee corrected these issues during inspections conducted in accordance with procedures EN-DP-01500, EN-DP-01501, and EN-DP-01502. For example, these procedures each contained requirements to confirm visual quality requirements during the inspection (e.g., discern lower case letters of 0.158 inches in height printed on a visual acuity “VT-2" card at six feet under a minimum of 15 foot candles of illumination). The licensee inspectors identified new areas of corrosion/boric acid deposits on components during inspections using these procedures, which had not been previously identified. This indicated a more thorough licensee inspection effort for SSCs under the DBCHAP than that previously completed under the “Containment Boric Acid Extent of Condition Plan.”

The boric acid or corrosion deposits observed on components by the NRC inspectors within containment (including the reactor vessel) had, in each case, been identified and documented by the licensee staff during these inspections. Therefore, the NRC inspectors concluded that the licensee had taken effective corrective actions to address the lack of inspection quality and thoroughness associated with implementation of the original licensee plans to inspect SSCs within containment.

b.1.2 Training and Certification of Inspection Personnel

The NRC had previously identified a finding (Green NCV 50-346/02-09-02) associated with failure to adequately train personnel that were VT-2 certified in accordance with the American Society of Mechanical Engineers Code (ASME) requirements. As a corrective action for this issue, the licensee developed a new standard to qualify/certify personnel as “Boric Acid Corrosion Control Inspectors.” This new standard required 60 hours of relevant work experience. The NRC inspectors reviewed licensee certification packages for 14 certified Boric Acid Corrosion Control Inspectors and noted that these personnel typically had extensive experience and/or previous training/certification in several nondestructive examination methods. The licensee trained and certified over 20 contract personnel to augment existing staff members in performing these inspections.

The NRC inspectors observed the classroom training and reviewed written examinations administered to the licensee contract inspectors. The training scope and depth was more extensive than that used in the original VT-2 Certification Process. Licensee staff had to pass a General and Specific written examination intended to meet qualification requirements for an ASME Code VT-2 visual examination. Additionally, licensee staff were given in-depth training and tested on the procedural requirements and expectations for the conduct of the boric acid/corrosion inspections. Further, licensee staff had to pass a practical examination on actual areas/components in containment. This practical examination included a standardized checklist of criteria which needed to be demonstrated by the student for a passing grade. Twenty-two licensee staff initially failed certification tests, which indicated that this series of certification tests was challenging. Most of these personnel were provided additional training and satisfactorily completed the certification process. The certification for each individual was recorded in a Job Familiarization Guideline that had specific requirements for each type of inspector (mechanical, structural, electrical) and was unique to each procedure used for conducting inspection of components for boric acid/corrosion.

The NRC inspectors concluded that the licensee had developed a well defined training standard with appropriate training and testing for the Boric Acid Corrosion Control Inspectors who conducted inspections of SSCs within containment. This corrective action adequately addressed the previous NRC finding associated with inadequate training of licensee support personnel for this activity.

b.2 Under-Vessel Inspections

The licensee performed inspections of the reactor vessel under the insulation in accordance with EN-DP-01500, "Reactor Vessel Inspection Procedure." To perform this inspection, the licensee staff reviewed the videotaped examination of the vessel that was made during July of 2002. This videotaped examination had been conducted with a remote camera system mounted to a robotic crawler. The licensee confirmed the visual fidelity of this system by recording examination of a VT-2 acuity card at distance of six feet. Further, near distance resolution was confirmed on this examination tape by placing the VT-2 card in close proximity with the camera lens. The NRC inspectors observed adequate resolution of letters on the VT-2 acuity card from near contact with the camera lense out to a distance of 6 feet. The NRC inspectors had previously documented review of the videotaped reactor vessel inspection in report 50-346/2002009 and considered that it provided an adequate visual examination record for the reactor vessel. The NRC inspectors also confirmed that the licensee inspection staff member performing the vessel inspection had completed the required training and was appropriately certified.

The licensee also specified a visual inspection of the reactor head including the bolting and flange area in attachment DB-0309 to this procedure, but had not yet completed this inspection. Licensee engineering staff, stated that these inspections would include visual inspection of all reactor head studs and holes. Further, licensee staff stated that ASME Code VT-3 visual acceptance criteria would be applied for inspections of these Code components. In areas near the cold leg nozzle piping and vessel 0-ring seal ring leak-off piping, access was limited for visual examinations due to the installed mirror insulation. The licensee documented these limitations on CR 02-02498 and the proposed corrective actions included sampling corrosion products for boron to assess the need to remove this insulation.

The NRC inspectors considered that the licensee had used appropriate tools and methods and had adequate procedural guidance to conduct the examination of the reactor vessel and identify potential boric acid related degradation.

b.3 Dissimilar Metal Weld and Threaded/Bolted Class 1 Joint Inspections

The licensee performed inspections of dissimilar metal welds (alloy 600 to steel or stainless steel) in accordance with EN-DP-01501, "Inspection of RCS Alloy 600, Components/Welds, Threaded/Bolted Connections and Targets." The licensee staff did not identify any indications of active leakage at the dissimilar metal welds during this inspection. However, the licensee was evaluating the dissimilar metal welds associated with the in-core penetration tubes at the bottom head of the vessel for potential leakage (reference report Section 4OA3.3.b.1). For the dissimilar metal weld examinations, the licensee's documentation included photographs, examination reports, and condition reports. This documentation appeared comprehensive and thorough.

The NRC inspectors observed licensee staff performing dissimilar metal weld inspections on piping attached to the RCS hot leg in the west D-ring. The NRC inspectors observed potential arc strikes near dissimilar metal welds HL1-7 and HL1-9 and minor boric acid residue on welds HL1-4 and HL1-5. The licensee inspectors had identified and documented each of these conditions. The NRC inspectors also confirmed that the licensee inspection staff performing these inspections had completed the required training and were appropriately certified.

The NRC inspectors considered the scope and quality of the dissimilar metal weld and threaded/bolted Class 1 joints inspections adequate to identify and characterize potential RCS leakage or degradation.

b.4 Containment Area Inspections

The NRC inspectors observed licensee staff performing inspections of areas at elevations of 565 feet and 585 feet in containment. These inspections were performed in accordance with EN-DP-1502 "Containment Area Inspections." This procedure required confirmation of inspection quality by use of a VT-2 acuity card at six feet or for remote viewing (e.g., binoculars) that the inspection quality was equivalent to that obtained by direct viewing. The NRC inspectors observed licensee staff performing visual acuity checks in accordance with the procedure including confirmation of adequate visual quality for examinations using binoculars. The NRC inspectors also observed licensee staff utilizing ladders to perform direct visual examination of components in areas with access restrictions, such as the feedwater line containment penetrations. For inspections which required several shifts to complete, the NRC inspectors observed the licensee staff annotating drawings to track completion of the inspection efforts. The NRC inspectors also confirmed that the licensee inspection staff performing the containment area inspections at elevations of 565 feet and 585 feet in containment had completed the required training and were appropriately certified.

The licensee staff identified new areas of corrosion that were not identified during the first inspection effort, which indicated that the licensee had conducted a more thorough examination. For example, rust or boric acid was identified at the refueling bridge track (CR 02-03808), welded pipe lugs at elevation of 565 feet in area number 9 (CR 02-03819), six spare containment penetrations at elevation 585 feet in area 3 (CR 02-03702), and on a pipe support at elevation 603 feet in area number 2S (CR 02-03780). The NRC inspectors did not identify any additional boric acid deposits or corrosion on components which had not already been identified by the licensee inspectors. For example, the NRC inspectors observed deposits of boric acid in cable trays below the service water piping at elevation 565 feet which had been appropriately identified and documented by the licensee staff.

The NRC inspectors observed licensee personnel using necessary equipment/ tools and following the inspection procedure. Further, the procedure provided adequate guidance to ensure a thorough inspection was conducted. Therefore, the inspectors concluded that the licensee had effectively implemented the containment area inspections and that these inspection were adequate to identify potential boric acid induced corrosion of safety-related components.

c. Findings

No findings of significance were identified.

.3 Resolution of Boric Acid Deposits and Corrosion on Components within Containment

a. Inspection Scope

The NRC inspectors reviewed a sample of CRs documenting corrective actions for components with boric acid induced corrosion, identified during the licensee inspections conducted under the DBCHAP. The NRC inspectors reviewed the scope and technical adequacy of the corrective actions identified in these CRs.

b. Observations

b.1 Corrective Actions for the Reactor Vessel

The licensee had documented corrective actions for deposits of boric acid and corrosion products identified on the reactor vessel in CR 02-02498. Corrective actions included sampling of boric acid deposits on the west hot leg and northwest cold leg and cleaning the reactor vessel to remove all boric acid residue, loose patches of surface coating and corrosion stains.

The licensee had completed cleaning on the outer surface of the reactor vessel using heated high pressure water. The NRC inspectors performed a direct visual examination of the vessel under the insulation from the annulus sump area below the vessel. Based on this inspection, the cleaning had been effective at removing boric acid residues and loose/peeling coatings which had been previously identified on the surface of the vessel (reference NRC report 50-346/2002-009). However, the cleaning method was not successful at removing the dark rust colored stains that covered areas of the vessel around the west hot leg and northwest cold leg.

The licensee staff believed that the corrosion stains on the vessel were likely caused by wash-down of boric acid and corrosion deposits removed from the vessel head during previous outages. To confirm this belief the licensee staff had taken samples at 12 of the 52 in-core penetration nozzles at the bottom head of the vessel and obtained additional samples of deposits along the sides of the vessel. The preliminary results of these samples were not conclusive and could not rule out the possibility that the lower in-core nozzle locations were leaking (reference CR 02-07059). The in-core nozzle tubes (Alloy 600 material) are connected to the reactor vessel lower head near the inside surface with J-weld (Alloy 182 weld metal). These materials are potentially susceptible to primary water stress corrosion cracking.

On October 9, 2002, NRR and Region III staff held a phone call with licensee management to discuss the preliminary results of sampling boric acid residue and rust/corrosion stains on the sides and bottom of the reactor vessel. The licensee staff reported that analysis of the samples was inconclusive with respect to the original supposition that these deposits on the vessel originated from the boron deposits washed down from the head and/or other maintenance activities. The licensee identified an unexpectedly high concentration of lithium and boron in some of the samples (potentially indicative of RCS leakage). Specifically, the licensee identified that samples tested from in-core nozzles number 3 and 27 exhibited elevated boron and lithium levels relative to other locations. The licensee also identified other elements in the samples at the bottom of the head such as uranium, cobalt, and iron-59 which were not expected. The licensee's vendor was evaluating this information at the conclusion of the inspection. However, the licensee could not obtain additional corrosion product samples on the vessel near the in-core penetration tubes, because these areas had been cleaned. The licensee stated that this issue was in the "discovery mode," and the sample analysis results received to date were inconclusive. The licensee vendor had generated a draft Preliminary Report of Safety Concerns, which when completed, would document the findings to the licensee, the NRC, and the Industry. The licensee staff indicated that this report was expected to be issued within two weeks. Pending NRC review of the licensee's investigation and specified corrective actions for the potential leakage at the reactor vessel in-core penetration tubes this issue is considered an unresolved item (URI 50-346/02-12-01).

At the conclusion of this inspection, the licensee had not yet documented the apparent causes or preventative corrective actions for the conditions identified on the vessel in CR 02-02498 and CR 02-07059. Additionally, the licensee had not yet completed inspections of the vessel flange or head studs (reference report Section 4OA3.2.b.2). Therefore, the NRC inspectors could not confirm the adequacy or completeness of the designated corrective actions.

b.2 Corrective Actions for the Loop 1 RCS Cold Leg Drain Valve

The licensee documented corrective actions for deposits of boric acid and corrosion products identified on the RCS loop 1 cold leg drain stop valve RC-39 in CR 02-01930. The licensee identified corrosion on the yoke, housing cover and cover studs of valve RC-39. Minor amounts of boric acid were also identified on the body to bonnet flange joint and upper surface of the body flange. The licensee considered the valve operable in the as found condition because the corrosion identified had not yet resulted in appreciable material loss. The licensee determined that the apparent cause of the boric acid deposits was due to a body-to-bonnet gasket leak; the apparent cause of the yoke corrosion was boric acid; and the apparent cause of the surface rust on the housing cover and fasteners was humidity in containment. The licensee's corrective actions to prevent recurrence of this condition included implementation of engineering work request number 02-0235 to replace the valve gasket and replace the yoke and other valve components with corrosion resistant materials. The licensee staff stated that they intended to complete this work and apply similar corrective actions for all of the eight loop drain valves with a similar vulnerability to boric acid corrosion prior to restart. The NRC inspectors concluded that the licensee's apparent causes was adequately supported by the conditions identified and that conservative corrective actions had been designated for this component.

b.3 Corrective Actions for Corroded Electrical Conduit

The NRC inspectors reviewed five CRs on electrical components in detail including the associated photographs which identified considerable corrosion in cable raceways and power and instrumentation enclosures. The NRC inspectors noted that corrosion appeared to be particularly concentrated at areas where moisture and boric acid from the containment atmosphere had condensed and dripped onto electrical components. In particular, the NRC inspectors noted substantial corrosion and deposits of crystallized boric acid on conduits. Based on this observation, the NRC inspectors identified a concern that boric acid corrosion of conduit may create a high electrical resistence and challenge the ground function of the electrical conduit.

The NRC inspectors were concerned with the condition of conduit connections to junction boxes, because of the potential for high resistance contact and the corresponding deleterious effect on the ground return path integrity. This concern was based on the conditions existing at a typical point of entry of a threaded conduit into a termination box. For example, the licensee took photographs associated with CR 02-02088, "585-5E/Room 317 - Containment Hatch Area," that show corrosion at the junction of conduit-to-box that may impair the ground path and cause an increase in the electrical resistance to the flow of electricity during a ground fault current. This condition in conjunction with an electrical system fault could result in a fire and failure of multiple electrical components with cables running inside the affected conduit. The licensee staff reportedly had considered this issue, but had not documented it, nor taken any action to investigate this concern. The licensee subsequently documented this issue in CR 02-06788. Pending NRC review of the licensee's investigation into the extent and significance of this concern, this issue is considered an unresolved item (URI 50-346/02-12-02).

b.4 Corrective Actions for Containment Air Cooler Motors

The inspectors reviewed the licensee's action plan CH-IAP-2c-01, "Containment Air Cooler - Implementation Action Plan." Under this plan, the licensee implemented replacement for two of the three containment air cooler (CAC) fan motors (#1 and #2) with new motors due to a 10 CFR Part 21 non conformance against associated with the original Reliance motors. The number 3 CAC fan motor was not a Reliance motor, but the licensee implemented motor replacement based on reliability concerns with a motor service age of approximately 20 years. For this motor replacement, the licensee used an existing re-built motor which was in the stock system.

The CAC motors were characterized by the type designation TEAO (Totally Enclosed, Air Over). Because these motors were totally enclosed, there is no ambient air circulation through the motor windings, and hence no possibility for boric acid entrained in the containment atmosphere to contaminate the motor windings. However, heat dissipation for these motors relied on air flow over the outside of the motor housing with the CAC motors located in the air stream. Therefore, the inspectors were concerned that a potential condition could exist where the boric acid and corrosion deposits on the motor housing surface could adversely affect motor heat dissipation. Further, the licensee had documented that boric acid deposits were found on the outside of the CAC motor housings.

The inspectors' concerns for CAC motor heat dissipation prompted the licensee to review the control room logs to determine if high motor temperature readings had ever been recorded. Each one of the CAC motors had 6 resistance temperature detectors (RTD's) installed in the stator slots and one thermocouple provided for each bearing. The motor RTD's provided an effective means of monitoring the motor winding temperature, giving an indication not only of the overall temperature of the winding, but also of any potential hot spots at strategically selected localized winding areas. Based on the licensee's review of CAC motor temperatures, no reports were documented associated with high motor winding temperatures. Therefore, the inspectors concluded that boric acid deposits did not adversely affect CAC motor heat dissipation.

During CAC motor replacement, the licensee identified splitting of the motor cable insulation as documented in CR 02-05459, "Cable insulation splitting for CAC motor field cables." The licensee declared the CACs inoperable for this condition. The inspectors reviewed the licensee's photographs of this condition which showed straight deep splits in the motor power cable insulation. Based upon this condition, the inspectors believed that the cable had been cut by a sharp instrument, rather than the result of an aging or contamination related mechanism. The licensee preliminarily determined that these splits were the result of improper maintenance activities for removal of the Raychem splices at the terminal ends of the motor cables. The work orders for CAC motor replacement had referenced maintenance procedure DB-ME-09500, "Installation and Termination of Electrical Cables," which provided detailed instructions on Raychem splice removal and splice removal training was part of lesson plan CON-TRM-1001.01, "Terminations for External Support Personnel." However, the inspectors questioned whether the licensee personnel involved in this activity were aware of procedure DB-ME-09500, which contained a caution note that stated "Applying too much pressure to the cutting instrument may cause intrusion into the cable beneath." The licensee was continuing to investigate wether the training and pre-job briefings for this activity were adequate and if similar maintenance activities had affected other equipment. Pending NRC review of the licensee's investigation into the extent and significance of the potential failure to follow the procedure for Raychem splice removal, this issue is considered an unresolved item (URI 50-346/02-12-03).

c. Findings

No findings of significance were identified.

.4 Conclusions on Containment Extent of Condition Inspections and Corrective Actions

The licensee implemented appropriate corrective actions to address the lack of inspection quality and thoroughness associated with implementation of the original "Containment Boric Acid Extent of Condition Plan." The inspections conducted under the DBCHAP were sufficiently comprehensive to identify the potentially degraded safety-related components affected by boric acid corrosion within containment. For these inspections, the licensee inspection staff were appropriately trained, equipped with adequate equipment/tools, and followed procedures with adequate quality standards and guidance. The net result was that boric acid or corrosion deposits observed by the NRC inspectors on components (e.g.,reactor vessel, hot-leg dissimilar metal welds, and electrical components) within containment were in each case, appropriately identified and documented by the licensee inspection staff. Therefore, inspectors concluded that the "Davis-Besse Containment Health Assurance Plan" was effectively implemented.

The inspectors identified three unresolved items associated with licensee corrective actions on components potentially affected by boric acid corrosion. These unresolved items were associated with the corrective actions implemented for boric acid corrosion of electrical conduit, the reactor vessel, and the containment air coolers. These issues were under review by the licensee to determine the scope and significance of each issue at the conclusion of this inspection. Additionally, the licensee had completed apparent cause determinations with designated corrective actions for only a small number of the components potentially affected by boric acid corrosion. For these reasons, the inspectors were not able to reach a general conclusion on the completeness or technical adequacy of corrective actions for structures systems and components affected by boric acid corrosion and Restart Checklist Item No. 2.c will remain open, pending additional NRC reviews in this area.

4OA6 Meetings

.1 Exit Meeting

The NRC inspectors presented the inspection results to Mr. L. Meyers and other members of licensee management at the conclusion of the inspection on October 24, 2002. The NRC inspectors asked the licensee whether any materials discussed as potential report material should be considered proprietary. No proprietary information was identified.

KEY POINTS OF CONTACT

Licensee

L. Myers, Vice President - Nuclear
R. Fast, Plant Manager
T. Chambers, Containment Health Manager
L. Pearce, Vice President - Oversight
R. Cook, Compliance Engineer, Regulatory Affairs
D. Eshelman, Director, Support Services
A. Alfred, Regulatory Affairs
D. Geisen, Manager, Design Engineering
M. McLaughlin, Containment Health Engineer
L. Makatura, Engineer
P. Jacobson , Electrical Engineer
G. Anderson, Mechanical Engineer
D. Jobsky, Purchasing Engineer
B. Kreinbihl, Electrical Engineer

Nuclear Regulatory Commission

C. Thomas, Senior Resident Inspector
D. Simpkins, Resident Inspector

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-346/02-12-01	URI	Potential leakage at the reactor vessel in-core penetration tubes
50-346/02-12-02	URI	Potential impact of corrosion on the ground function of electrical conduit in containment
50-346/02-12-03	URI	Potential failure to follow the procedure for Raychem splice removal on electrical cables

Closed

None

Discussed

50-346/02-09-01	NCV	Failure to provide acceptance criteria or requirements to follow the inspection plans
50-346/02-09-02	NCV	Failure to adequately train personnel that were VT-2 certified

LIST OF ACRONYMS USED

ASME	American Society of Mechanical Engineers
CAC	Containment Air Cooler
CFR	Code of Federal Regulations
CR	Condition Report
CRDM	Control Rod Drive Mechanism
DBCHAP	Davis-Besse Containment Health Assurance Plan
DRS	Division of Reactor Safety
NCV	Non-Cited Violation
NRC	Nuclear Regulatory Commission
NRR	Office of Nuclear Reactor Regulation
QA	Quality Assurance
RCS	Reactor Coolant System
RTD	Resistance Temperature Detector
SDP	Significance Determination Process
SSCs	Systems, Structures and Components
TEAO	Totally Enclosed, Air Over

LIST OF DOCUMENTS REVIEWED

Certification of Qualification (Boric Acid Corrosion Control Inspector)

J. Henge	August 1, 2002
E. Hampton	July 31, 2002
B. Reineck	July 29, 2002
J. Pass	July 29, 2002
J. Price	July 29, 2002
T. Thompson	July 15, 2002
P. Valden	July 29, 2002
J. Marly	July 30, 2002
A. Migas	July 29, 2002
D. Peterson	July 29, 2002
T. Brown	July 29, 2002
T. Jackson	July 31, 2002
W. Oebosk	July 29, 2002
M. Murtha	August 1, 2002

Condition Reports

02-01753	Inspection of area 565-9S
02-01930	Boric Acid Deposits and Corrosion on RC-39
02-01954	Electrical Equipment in Area 603-2E
02-02088	585-5E/ Containment Hatch Area
02-02498	Reactor Vessel
02-02739	Debris from Head Cleaning may be Source of Stains on Vessel
02-02943	Containment Air Coolers
02-03316	Reactor Flange
02-03619	CAC electrical Boxes
02-03702	Area 585-3S Core Flood Tank #1 Area
02-03709	585-6E/ Outside D-ring between Rooms 315 and 316

Condition Reports

02-01753	Inspection of area 565-9S
02-03734	Tee Fitting H, Flange 37A/37B, Flange 30A/30B
02-03753	Extent of Condition Reinspection of PZR-08 Level Tap Nozzle
02-03766	Boric Acid in Cavity Seal Area
02-03780	Room 410-East Passage Penetration Area
02-03790	565-9E Room 220--Incore Instrument Trench Area
02-03806	603-4S-RI/Area Above Refueling Canal
02-03819	Containment Shell
02-04002	Inspection of Area 585-5E
02-04025	Reinspection of Area 603-1S
02-04192	565-8E Outside D-Ring between Rooms 217 and 220
02-05459	Cable Insulation Splitting for CAC Motor Field Cables
02-05461	Containment Emergency Sump
02-06296	Environmentally Qualified Equipment Plan too Narrow
02-06788	Boric Acid May Have Degraded the Neutral Conductor for Three Phase Loads

Drawing

ISIM2-230B	Inservice Inspection Isometric Reactor Coolant System	Revision 3

Extent of Condition Examination Reports

585-4P	Outside D-Ring Between Rooms 316 and 317	August 22, 2002
585-4S-RI	Outside D-Ring Between Rooms 316 and 317	August 06, 2002
585-3S-RI	Core Flood Tank No. 1 Area	August 12, 2002
585-3	Piping	August 09, 2002
585-5E	Room 317 Containment Hatch Area	August 12, 2002
565-9E-RI	Room 220--Incore Instrument Trench Area	August 12, 2002
565-9S-RI	Room 220--Incore Instrument Trench Area	August 12, 2002
603-1S-RI	Containment Hatch Area	August 12, 2002

ISIM2-230B	Inservice Inspection Isometric Reactor Coolant System	Revision 3
603-4S-RI	Area Above Refueling Canal	August 10, 2002
603-2S-RI	Room 410-East Passage Penetration Area	August 12, 2002
IP-M-028 Attachment 1 Data Sheet	RC39 Bolted, Loop 1 Cold Leg Drain Stop Valve	May 10, 2002
DB-0290-0	PT-RC2A3T-RI/ PT-RC2A3-RI	August 18, 2002
DB-0290-1	603-1S-RI	August 12, 2002

Other Documents

DBE-0001	Engineering Assessment Board Role/Policy in Support of the Return to Service Plan	Revision 0
NOP-ER-2001	Boric Acid Corrosion Control Program	Revision 0
NG-EN-00324	Boric Acid Corrosion Control	Revision 4
	Davis Besse Boric Acid Corrosion Control Inspector Program White Paper	July 20, 2002
QCT-MEC-1201	CTMT Extent of Condition Walkdown Procedures Tabletop Review Classroom Training	July 19, 2002
JFG TSM-108	Mechanical Boric Acid Corrosion Control Inspector (Applicable to EN-DP-01501 only)	Revision 0
JFG TSM-105	Mechanical Boric Acid Corrosion Control Inspector (Applicable to EN-DP-01500 only)	Revision 0
JFG TSM-106	Electrical and Control Boric Acid Corrosion Control Inspector (Applicable to EN-DP-01502 only)	Revision 0
JFG TSM-107	Civil/Structural Boric Acid Corrosion Control Inspector (Applicable to EN-DP-01502 only)	Revision 0
JFG TSM-109	Mechanical Boric Acid Corrosion Control Inspector (Applicable to EN-DP-01502 only)	Revision 0
QCT-MEC-1201	Containment Extent of Condition Walkdown Procedures Tabletop Review Classroom Training	

Howden Buffalo letter to NRC Document Control Desk	Subject: 10CFR21 Reporting of Defects and Noncompliance	May 16, 2002
Reliance Electric Report to NRC	NRC Event 38909	May 9.2002
7096792	First Energy Purchase Order	September 17, 2002
CAC Motor Data	Exhibit 1 of Procurement Package 89300101	Revision 5
Lesson Plan CON-TRM-I001.01	Terminations for External Support Personnel	

Plans

	Davis-Besse Containment Health Assurance Plan	Revisions 4 and 5
CH-DAP-2c-03	Containment Health Assurance Discovery Action Plan	Revision 0
CH-DAP-2c-01	Emergency Sump Discovery Action Plan	Revision 0
CH-DAP-2b-01	Containment Vessel Liner Discovery Action Plan	Revision 0
CH-IAP-2b-01	Containment Vessel Liner Implementation Action Plan	Revision 0
CH-IAP-2c-01	Containment Air Coolers Implementation Action Plan	Revision 0
CH-DAP-2c-04	Containment Coatings Discovery Action Plan	Revision 0
CH-DAP-2c-02	Containment Equipment EQ Discovery Action Plan	Revision 0
DBE-0001	Engineering Assessment Board Role/Policy in Support of the Return to Service Plan	Revision 0

Procedures

EN-DP-1500	Reactor Vessel Inspection Procedure	Revision 3
EN-DP-1501	Inspection of RCS Alloy 600 Components/Welds, Threaded/Bolted Connections and Targets	Revision 3
EN-DP-1502	Containment Area Inspections	Revision 1

EN-DP-01507	Containment Walkdown for Potential Sump Screen Debris Sources	Revision 0
DB-ME-09500	Installation and Termination of Electrical Cables	Revision 3

Work Orders

02-002975-000	Motor for Containment Air Cooler Fan 1	Revision 0
02-002976-000	Motor for Containment Air Cooler Fan 2	Revision 0
02-003574-001	Motor for Containment Air Cooler Fan 3	Revision 0