WOLF CREEK
NUCLEAR OPERATING CORPORATION

Richard A. Muench
Vice President Technical Services

APR 0 3 2002

ET 02-0018

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
11555 Rockville Pike
Rockville, MD 20852

Subject: Docket No. 50-482: Response to NRC Bulletin 2002-01, "Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity"

Gentlemen:

Attachment II contains the Wolf Creek Nuclear Operating Corporation (WCNOC) response to U.S. Nuclear Regulatory Commission (NRC) Bulletin 2002-01, "Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity" dated March 18, 2002. NRC Bulletin 2002-01 requires information relative to the integrity of the reactor coolant pressure boundary, previous inspections in accordance with applicable regulatory requirements, compliance with regulatory requirements related to the structural integrity of the reactor coolant pressure boundary, and plans for future reactor coolant pressure boundary inspections. This letter is submitted consistent with the guidance in NEI letter from Alexander Marion dated March 25, 2002, regarding the response date of this bulletin. Attachment III contains a list of commitments made in this letter.

If you should have any questions regarding this submittal, please contact me at (620) 364-4034, or Mr. Tony Harris at (620) 364-4038.

Very truly yours,

Richard A. Muench

RAM/krp

Attachments:
I - Affidavit
II - Response to NRC Bulletin 2002-01
III - List of Commitments

cc: J. N. Donohew (NRC), w/a
D. N. Graves (NRC), w/a
E. W. Merschoff (NRC), w/a
Senior Resident Inspector (NRC), w/a

A095

**STATE OF KANSAS )**
**) SS**
**COUNTY OF COFFEY )**

Richard A. Muench, of lawful age, being first duly sworn upon oath says that he is Vice President Technical Services of Wolf Creek Nuclear Operating Corporation; that he has read the foregoing document and knows the contents thereof; that he has executed the same for and on behalf of said Corporation with full power and authority to do so; and that the facts therein stated are true and correct to the best of his knowledge, information and belief.

By _____
Richard A. Muench
Vice President Technical Services

SUBSCRIBED and sworn to before me this 3rd day of April, 2002.

NOTARY PUBLIC STATE OF KANSAS — CINDY NOVINGER — My Appt. Exp. 7/8/02

_____
Notary Public

Expiration Date July 8, 2002

**Response to NRC Bulletin 2002-01**
**Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity**

Below is the Wolf Creek Nuclear Operating Corporation (WCNOC) response to Nuclear Regulatory Commission (NRC) Bulletin 2002-01, "Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity," dated March 18, 2002. The Bulletin's "Required Information" is shown in bold.

**Required Information**

1. **Within 15 days of the date of this bulletin, all PWR addressees are required to provide the following:**

   A. **a summary of the reactor pressure vessel head inspection and maintenance programs that have been implemented at your plant,**

**Response**

WCNOC performs routine visual inspections that identify boric acid deposits and/or reactor coolant system (RCS) leakage that could cause degradation of the reactor vessel head. These inspections are performed under the auspices of Generic Letter 88-05 (Reference 1) and ASME Section XI (Reference 2) and are described below.

In addition to the inspections described below, on March 31, 2002, WCNOC completed a remote visual inspection of the entire bare metal head of the reactor vessel. This inspection was performed to support an engineering evaluation of the condition of the vessel head relative to the issues addressed in NRC Bulletin 2002-01. No evidence of reactor vessel head degradation was found during this inspection. Plans for future inspections of this type are described in our response 1.D. below.

Boric Acid Leak Inspection

Boric acid corrosion inspection (BACINS) walkdowns are performed each refueling outage. BACINS walkdowns are performed during other outages at the discretion of plant management. Locations that are susceptible for leakage onto the reactor vessel head are specifically identified for inspection. The walkdowns are performed early in refueling outages to identify active leakage and to ensure evidence of RCS leakage, if discovered at the leakage sites, is not disturbed prior to evaluation. Evidence of leakage above the reactor vessel head insulation is documented and evaluated in accordance with WCNOC work controls and corrective action programs.

ASME Section XI Pressure Boundary Inspection

Inspections within the scope of ASME Section XI (i.e., VT-2 visual examinations) are performed at normal operating pressure and normal operating temperature (NOP/NOT) following each refueling outage. Evidence of leakage above the reactor vessel head insulation is documented and evaluated in accordance with WCNOC work controls and corrective action programs.

The reactor vessel head welds, and head studs and nuts are inspected in accordance with the WCNOC ASME Section XI Inservice Inspection Program Plan. The reactor vessel head welds receive periodic ultrasonic examination (UT); the studs receive periodic magnetic particle examination (MT)/UT examination; and the nuts receive periodic visual examination (VT-1). The components described above are examined at least once in every 10-year examination period. Boric acid corrosion degradation would be identified during these examinations.

Other Programs

Although not a specific inspection or maintenance program, boric acid deposits or leakage identified during other work activities are addressed in accordance with the WCNOC BACINS program using the corrective action program. Evidence of boric acid deposits or leakage would be readily visible during work activities such as efforts to identify reactor coolant system (RCS) leakage associated with Technical Specification 3.4.13, RCS Operational Leakage, and other refueling activities near the reactor pressure vessel (RPV) head [e.g., core exit thermocouple (CET) removal and installation, control rod drive mechanism (CRDM) maintenance, CRDM cooling ductwork removal, and RCS drain/fill and vent].

**Required Information**

1. **Within 15 days of the date of this bulletin, all PWR addressees are required to provide the following:**

   **B. an evaluation of the ability of your inspection and maintenance programs to identify degradation of the reactor pressure vessel head including, thinning, pitting, or other forms of degradation such as the degradation of the reactor pressure vessel head observed at Davis-Besse,**

**Response**

Relative to existing inspection and maintenance programs, WCNOC has access to all surfaces of components above the insulation that could potentially leak boric acid onto the head. All joints (mechanical or welded) above the RPV penetrations are visible above the head insulation. These include CRDMs, CET columns, reactor vessel level indicating system (RVLIS) piping, and reactor vessel head vent piping and components. Visual inspection inside the CRDM cooling shroud and atop the CRDM seismic support platform would reveal leakage from any of the aforementioned components without requiring the removal of any insulation. Therefore boric acid residue or leakage from any joint above the RPV penetrations, including the resultant flow path, would be readily evident.

Also, the RPV head insulation outside the CRDM cooling shroud is removed during each refueling outage. This insulation removal provides direct visual access to the RPV head below the CRDM cooling shroud and to the reactor vessel flange, studs, nuts and washers. Appreciable boric acid leakage onto the RPV head from above or below the insulation, such as the conditions observed at Davis Besse, would be identified as visible deposits in this region.

Boric acid deposits identified during inspections are evaluated in accordance with the WCNOC boric acid corrosion inspection program described in our response to 1.A. above.

The existing inspection and maintenance programs do not include all examinations necessary to identify reactor vessel head thinning or pitting, or the type of degradation found at Davis-Besse in its early stages (i.e., small leaks from RPV head penetration nozzles below the insulation). However, WCNOC has reasonable assurance that Wolf Creek Generating Station (WCGS) is unlikely to have any leakage from head penetration nozzle cracking. This assurance is based on the industry ranking of low susceptibility for WCGS, as well as good agreement between industry inspection results to date and the EPRI Material Reliability Program (MRP) susceptibility ranking model.

No evidence of leakage from these penetrations or of reactor vessel head degradation was found in the remote visual inspection conducted during the current refueling outage (Refuel 12). The inspection plan and associated administrative controls for the remote visual inspection conducted during the current refueling outage included acceptance criteria and process controls for evaluating inspection findings. The tools, techniques, and procedures employed are consistent with the applicable requirements of an "effective visual exam" of the CRDM penetration nozzles as defined in NRC Bulletin 2001-01 (Reference 3). Areas of carbon steel below the CRDM cooling shroud support ring were examined using direct visual (VT-2) examination.

**Required Information**

1. **Within 15 days of the date of this bulletin, all PWR addressees are required to provide the following:**

   C. **a description of any conditions identified (chemical deposits, head degradation) through the inspection and maintenance programs described in 1.A that could have led to degradation and the corrective actions taken to address such conditions,**

**Response**

As noted above, WCNOC has completed an effective visual examination of the entire reactor vessel head. There was no evidence of leakage through the CRDM nozzles or evidence of wastage due to boron deposits. During the visual examination, minor amounts of loose boron residue were identified, but it was of such a nature that it would not hide indication of boric acid corrosion.

In addition, a search of the WCNOC work controls and corrective action programs was performed to identify any historical boric acid leaks that could have led to degradation of the reactor vessel head. Historical records and personnel interviews indicate that identified potential leakage paths were evaluated to the point of providing confidence that no conditions existed that could have led to degradation of the RPV head. The results of the documentation search are described below.

During refueling outage three (RF3) in 1988, the BACINS program identified small boric acid deposits on the canopy seal welds on five CRDM columns and one CET column. No active leakage was identified. All locations were cleaned, followed by successful liquid penetrant examinations (PT). The ASME Section XI system leakage test at the end of the outage did not identify leakage at any of these locations.

In RF4, no items were identified.

During RF5 in 1992, the ASME Section XI system leakage test identified boric acid accumulation on a thermocouple conduit on a CET column. The boric acid was cleaned, followed by a visual examination. No active leakage was identified.

During a forced outage in 1992, the BACINS program identified leakage from the head vent valves. All four head vent valves were refurbished, but leakage through the seats was observed as pressure was increased. A drip pan was installed to prevent the leakage from reaching components below the CRDM seismic support platform, including the RPV head. The BACINS program also identified boron deposits and leaks at the canopy seal welds on two CRDM columns. Canopy seal clamp assemblies (CSCAs) were installed around the welds on both CRDM columns. VT-2 examinations identified no leaks. To facilitate installing these clamps, portions of the RPV head insulation were removed or rearranged such that the bare head was exposed. While no specific inspections for boric acid accumulation were documented, the bare head around the penetrations was visible during this evolution, and no boric acid deposits were reported. In addition the CET conduit identified in RF5 was repaired. No leaks were identified in the VT-2.

During a forced outage later in 1992, the BACINS program identified boron deposits on the canopy seal weld on one CRDM column. No active leak was identified. A re-inspection was deferred until RF6.

During RF6 in 1993, the BACINS program identified boric acid deposits on the same CRDM column canopy seal weld. No active leakage was identified. A CSCA was installed around the CRDM column weld. A VT-2 examination identified no leaks. To facilitate installing the clamp, portions of the RPV head insulation were removed or rearranged such that the bare head was exposed. While no specific inspections for boric acid accumulation were documented, the bare head was visible during this evolution and no boric acid deposits were reported. The ASME Section XI system leakage test at the end of the outage identified boric acid residue on a RVLIS fitting. The boric acid was cleaned and a visual examination identified no leaks.

During RF7 in 1994, the BACINS program identified potential boron accumulation on one CET column. No active leakage was identified. An evaluation concluded that the discoloration may not be boric acid. A re-inspection was deferred until RF8.

In a forced outage in 1995, the BACINS program identified boron accumulation on a mechanical joint on a different CET column. No active leakage was identified. The deposits were cleaned and a visual examination identified no leakage.

During a forced outage in 1996, the BACINS program identified an active leak on the same CET column joint where boron was identified in 1995. An evaluation concluded that this leak would not result in boric acid deposits on the RPV head. Actions to repair the leak were deferred to RF8 scheduled to start in approximately 30 days.

During RF8 in 1996, the BACINS program documented the same active leak on the CET column joint identified 30 days earlier. The seal was repaired. No leaks were identified in the VT-2.

In a forced outage in 1997, the BACINS program identified boric acid deposits on a canopy seal weld on one CRDM column. No active leakage was identified. A re-inspection was deferred until RF9.

During RF9 in 1997, the BACINS program identified boric acid deposits on the same canopy seal weld identified earlier in 1997. A re-inspection of the canopy seal weld identified no active leakage and the weld was cleaned. No leaks were identified in the PT. A head vent valve was identified as leaking past the valve seat. The valve was reworked. Boron accumulation and an active leak was identified on one CET column joint. The leak was identified as slight, and the clamp bolts were re-torqued. No leaks were identified in the VT-2. The ASME Section XI system leakage test at the end of the outage identified evidence of a small boric acid leak on a canopy seal weld on one CRDM column, and a potential boric acid deposit on another CRDM column. No active leaks were identified on either location.

During RF10 in 1999, based on expected potential leakage sites identified in 1997, CSCAs were installed around welds on three CRDM columns. To facilitate installing the clamps, a portion of the RPV head insulation was removed or rearranged such that the bare head was exposed. While no specific inspections for boric acid accumulation were documented, the bare head was visible during this evolution and no boric acid deposits were reported. The ASME Section XI system leakage test identified a RPV head vent valve leaking borated water into a drip pan. The pan was drained prior to startup.

During RF11 in 2000, the BACINS program identified boric acid deposits on canopy seal welds on four CRDM columns. No active leakage was identified. Three of the welds were not cleaned due to minor amount of deposit. One weld was cleaned and visually inspected and no leakage was identified.

During RF12 in 2002, the BACINS program identified boric acid deposits on canopy seal welds on two CRDM columns. No active leakage was identified. RPV head vent valves were found to be leaking. The leak was not contained by the drip pans and boric acid accumulations were documented on the CRDM seismic support platform, the upper and lower CRDM cooling shroud, the RPV head insulation and the RPV flange insulation. Evaluation and actions associated with findings in RF12 are ongoing.

As confirmed by the remote visual inspection conducted during RF 12, the potential leaks or boric acid deposits identified in the historical records search above did not result in significant boric acid deposits or degradation of the reactor vessel head.

**Required Information**

1. **Within 15 days of the date of this bulletin, all PWR addressees are required to provide the following:**

   D. **your schedule, plans, and basis for future inspections of the reactor pressure vessel head and penetration nozzles. This should include the inspection method(s), scope, frequency, qualification requirements, and acceptance criteria,**

**Response**

As described above, WCNOC has completed an inspection of the RPV head. Inspection methods, scope, frequency, qualification requirements, and acceptance for any future inspections are pending the final results of the failure analysis at Davis-Besse, industry inspection results, and ongoing industry initiatives. Once this information becomes available, WCNOC will reevaluate current programs and practices for identifying, evaluating, cleaning, and preventing operational leaks that could cause degradation of the reactor vessel head.

Where appropriate, such programs and practices will be enhanced. Results of this evaluation will be described in the response required by item 3.A. below. These actions provide continuing assurance of compliance with the applicable regulatory requirements discussed in Generic Letter 88-05 and this bulletin.

**Required Information**

1. **Within 15 days of the date of this bulletin, all PWR addressees are required to provide the following:**

   E. **your conclusion regarding whether there is reasonable assurance that regulatory requirements are currently being met (see the Applicable Regulatory Requirements, above). This discussion should also explain your basis for concluding that the inspections discussed in response to Item 1.D will provide reasonable assurance that these regulatory requirements will continue to be met. Include the following specific information in this discussion:**

      (1) **If your evaluation does not support the conclusion that there is reasonable assurance that regulatory requirements are being met, discuss your plans for plant shutdown and inspection.**

      (2) **If your evaluation supports the conclusion that there is reasonable assurance that regulatory requirements are being met, provide your basis for concluding that all regulatory requirements discussed in the Applicable Regulatory Requirements section will continue to be met until the inspections are performed.**

**Response**

Wolf Creek Generating Station has reasonable assurance that regulatory requirements pertaining to reactor coolant pressure boundary integrity are being met and will continue to be met between future inspection periods. The following information provides the basis for conformance with current regulatory requirements and provides the basis that reasonable assurance exists for future conformance with regulatory requirements.

Conformance with Current Regulatory Requirements

The NRC Bulletin 2002-01 section entitled Applicable Regulatory Requirements cites the following regulatory requirements as providing the basis for the bulletin assessment:

- Appendix A, 10 CFR Part 50, *General Design Criteria for Nuclear Power Plants,*
  - Criterion 14 - *Reactor Coolant Pressure Boundary*
  - Criterion 31 - *Fracture Prevention of Reactor Coolant Boundary*
  - Criterion 32 - *Inspection of Reactor Pressure Coolant Pressure Boundary*
- 10 CFR 50.55a, Codes and Standards, which incorporates by reference ASME Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components*
- Appendix B, 10 CFR Part 50, *Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants,*
  - Criterion V - *Instructions, Procedures, and Drawings*
  - Criterion IX - *Control of Special Processes*
  - Criterion XVI – *Corrective Action*
- Plant Technical Specifications
- NRC Generic Letter 88-05

General Design Criteria (GDC):

As part of its original design and licensing, WCNOC demonstrated that the design of the reactor coolant pressure boundary meets these requirements. WCNOC complied with these criteria in part by: 1) selecting corrosion resistant materials with high fracture toughness for the reactor coolant pressure boundary, and 2) following NRC approved ASME Codes and Standards and other applicable requirements for design, fabrication, erection, and testing of the pressure boundary parts. As described above, the requirements established for design, fracture toughness, and inspectability in GDC 14, 31, and 32, respectively, were satisfied during the initial design and licensing, and continue to be satisfied during operation, even in the presence of a potential for primary water stress corrosion cracking of the reactor pressure vessel head penetration nozzles.

WCGS is categorized in the low susceptibility range based upon the NRC Bulletin 2001-01 susceptibility rankings. Visual and non-visual non-destructive examination data gathered to date continues to support the EPRI MRP time-at-temperature model as an effective management tool to predict susceptibility to head penetration nozzle cracking. Based upon the industry susceptibility ranking and good agreement with inspection results to date, WCNOC has concluded that WCGS is extremely unlikely to have any leakage from head penetration nozzle cracking.

As part of the resolution of the issues identified in NRC Generic Letter 97-01 and earlier correspondence regarding degradation of CRDM nozzles and other reactor pressure vessel head penetrations, evaluations and assessments concluded there would be a significant time between initiating a leak and experiencing wastage that would reduce the structural integrity margins of the reactor pressure vessel head below acceptable levels. Considering the length of time involved, WCNOC has reasonable assurance that leakage manifested by the accumulation of moderate amounts of boric acid crystals would be detected during the inspection and maintenance activities identified in our response to 1.A. above before a GDC non-conformance could occur.

Inspection Requirements (10 CFR 50.55a and ASME Section XI):

NRC Bulletin 2002-01 describes the requirements for inspection in accordance with the ASME Code, detection of leakage from insulated components, and the acceptance standards if through wall leakage is detected. WCNOC complies with the inspection requirements for insulated components as part of the WCNOC inservice inspection program.

Since the head is insulated, and the CRDM nozzles do not represent a bolted flange, the Code permits these inspections to be performed with the insulation left in place. WCNOC also complies with the Generic Letter 88-05 program by performing walkdowns during refueling outages and other shutdowns as described in the response to 1.A. above. If conditions are identified in the course of these inspections, corrective actions are performed, including supplemental examinations, repairs and/or evaluations.

Quality Assurance Requirements (10 CFR 50, Appendix B):

WCNOC administrative controls comply with requirements of 10 CFR 50, Appendix B, Criterion V (Instructions, Procedures, and Drawings), Criterion XI (Control of Special Processes), and Criterion XVI (Corrective Action). Implementation of these administrative controls relative to inspection and evaluation of boric acid deposits and/or reactor coolant system (RCS) leakage that could cause degradation of the reactor vessel head is described in 1.A above.

Plant Technical Specifications:

The limits for WCGS reactor coolant system leakage are provided in Technical Specification 3.4.13, and are stated in terms of the amount of leakage. Routine surveillance testing is performed to ensure these requirements are met. Based on industry experience, reactor coolant system leaks from RPV penetrations have been well below the sensitivity of on-line leakage detection systems. If measurable leakage is detected by the on-line leak detection systems, evaluations and actions will be performed per the Technical Specifications requirements. WCNOC continues to meet the Technical Specifications requirements.

NRC Generic Letter 88-05:

As discussed in 1.A above, WCNOC has implemented the BACINS inspection and walkdown program in response to NRC Generic Letter 88-05.

Conclusion:

Based upon the evaluation provided above, compliance with Technical Specification requirements, and the visual inspections completed in the current refueling outage, WCNOC complies with the regulatory requirements described in NRC Bulletin 2002-01.

Future Conformance with Regulatory Requirements

As stated in response to item 1.D. above, WCNOC will implement appropriate enhancements to administrative controls to identify, evaluate, and to the extent practical prevent leakage of borated water that could cause degradation of the reactor vessel head. Reinspection of the bare metal reactor vessel head under the insulation will be performed 1) as necessary to support an engineering evaluation of an identified leak, consistent with the Generic Letter 88-05 program requirements or 2) as a scheduled activity on a frequency to be established later in consideration of the root cause conclusions from the Davis-Besse event and the inspection recommendations of ongoing industry initiatives. Such inspections will be performed in compliance with Criterion V and IX of Appendix B to 10CFR 50. All conditions identified through these activities that could cause degradation of the reactor vessel head will be evaluated under existing site programs that comply with the requirements of Criterion XVI of Appendix B to 10CFR 50. These actions will provide reasonable assurance that the applicable regulatory requirements are being met on a continuing basis.

**Required Information**

**2. Within 30 days after plant restart following the next inspection of the reactor pressure vessel head to identify any degradation, all PWR addressees are required to submit to the NRC the following information:**

**A. the inspection scope (if different than that provided in response to Item 1.D.) and results, including the location, size, and nature of any degradation detected,**

**B. the corrective actions taken and the root cause of the degradation.**

**Response**

WCNOC will provide the required information within 30 days after plant restart following the current refueling outage. Based on current outage schedules, the submittal will be provided in May, 2002.

**Required Information**

3. **Within 60 days of the date of this bulletin, all PWR addressees are required to submit to the NRC the following information related to the remainder of the reactor coolant pressure boundary:**

   A. **the basis for concluding that your boric acid inspection program is providing reasonable assurance of compliance with the applicable regulatory requirements discussed in Generic Letter 88-05 and this bulletin. If a documented basis does not exist, provide your plans, if any, for a review of your programs.**

**Response**

WCNOC will provide the required information by May 17, 2002.

**References**

1. NRC Generic Letter 88-05, Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants, dated March 17, 1988

2. ASME Boiler and Pressure Vessel Code, Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, 1989 Edition

3. NRC Bulletin 2001-01, Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles, dated August 3, 2001.

## LIST OF COMMITMENTS

The following table identifies those actions committed to by Wolf Creek Nuclear Operating Corporation (WCNOC) in this document. Any other statements in this submittal are provided for information purposes and are not considered to be commitments. Please direct questions regarding these commitments to Mr. Tony Harris, Manager Regulatory Affairs at Wolf Creek Generating Station, (620) 364-4038.

| COMMITMENT | Due Date/Event |
|---|---|
| WCNOC will provide the inspection scope and results of the inspection of the reactor pressure vessel head. (NRC Bulletin 2002-01, Required Information 2) | Within 30 days after plant restart following the current refueling outage (Refuel 12). |
| WCNOC will provide the basis for concluding that the WCNOC BACINS program for the RCS pressure boundary is providing reasonable assurance of compliance with Generic Letter 88-05 and Bulletin 2002-01 regulatory requirements, or plans for a review of the program. Also WCNOC will provide the schedule, plans, and basis for future inspections of the reactor pressure vessel head and penetration nozzles. (NRC Bulletin 2002-01, Required Information 3, and 1.D.) | May 17, 2002 |