WOLF CREEK
NUCLEAR OPERATING CORPORATION

Richard A. Muench
President and Chief Executive Officer

JAN 31 2003

WM 03-0007

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Reference: Letter ET 02-0021, dated May 16, 2002, from Gary B. Fader, WCNOC, to USNRC

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

Gentlemen:

Attachment I to this letter provides the Wolf Creek Nuclear Operating Corporation (WCNOC) response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information for NRC Bulletin 2002-01, "Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity," dated November 21, 2002. Specifically requested is additional information relative to WCNOC's response to the 60-day requirement of NRC Bulletin 2002-01 (Reference) concerning the portions of the reactor coolant pressure boundary (RCPB) other than the reactor pressure vessel (RPV) head.

Attachment II lists WCNOC's commitments contained in this correspondence. If you have any questions concerning this matter, please contact me at (620) 364-4000, or Mr. Tony Harris at (620) 364-4038.

Very truly yours,

Richard A. Muench

RAM/rlg

A095

Attachments: I - Response to RAI for NRC Bulletin 2002-01
II - 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

STATE OF KANSAS)
) SS
COUNTY OF COFFEY)

Richard A. Muench, of lawful age, being first duly sworn upon oath says that he is President and Chief Executive Officer 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 [signature]
Richard A. Muench
President and Chief Executive Officer

SUBSCRIBED and sworn to before me this 31st day of Jan., 2003.

[signature]
Notary Public

NOTARY PUBLIC STATE OF KANSAS CINDY NOVINGER My Appt. Exp. 7/8/06

Expiration Date 7/8/06

Response to Request for Additional Information
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 the U.S. Nuclear Regulatory Commission (NRC) letter dated November 21, 2002 and entitled *Bulletin 2002-01, "Reactor Pressure Vessel Head Degradation And Reactor Coolant Pressure Boundary Integrity," 15-day and 60-day Responses for Wolf Creek Generating Station – Request for additional Information (TAC NO. MB4592)*

The RAI specifically requests additional information concerning the portions of the RCPB other than the reactor pressure vessel (RPV) head. Therefore, the responses below address all of the RCPB except the RPV head. The RAI's Questions are shown in bold.

WCNOC fully complies with American Society of Mechanical Engineers (ASME) Section XI requirements, as provided for in 10 CFR 50.55a. It is assumed that a review of these requirements is not the subject for the Request for Additional Information (RAI) and is not included here, unless specifically noted. For example, question one states, in part, "...examination of Alloy 600 pressure boundary material and dissimilar metal Alloy 82/182 welds..." Even though the steam generator heat transfer tubing is made of Alloy 600 material and is part of the reactor coolant pressure boundary (RCPB), WCNOC's response does not mention the ASME Section XI Code examination requirements associated with the steam generator heat transfer tubing. Similarly, WCNOC's response does not mention the ASME Section XI Code requirements of Examination Category B-F, "Pressure Retaining Dissimilar Metal Welds". Where ASME Code mandated examinations were deemed pertinent to the discussion of boric acid leakage identification, such as VT-2 examinations, mention is made for clarity and completeness of response.

<u>**RAI Question**</u>

1. **"Provide detailed information on, and the technical basis for, the inspection techniques, scope, extent of coverage, and frequency of inspections, personnel qualifications, and degree of insulation removal for examination of Alloy 600 pressure boundary material and dissimilar metal Alloy 82/182 welds and connections in the reactor coolant pressure boundary (RCPB). Include specific discussion of inspection of locations where reactor coolant leaks have the potential to come in contact with and degrade the subject material (e.g., reactor pressure vessel (RPV) bottom head)."**

<u>**WCNOC Response**</u>

<u>Inspection Techniques</u>
VT-2 visual examination is the technique used in WCNOC's boric acid inspections to identify potential boric acid leakage in the RCPB. The basis for acceptability of using visual examination for identifying boric acid leakage is the extensive industry experience with the use of visual examination techniques. Industry experience has shown that boric acid leakage is readily identifiable visually, including wetting caused by relatively large leakage and dry deposits from relatively small leakage.

In addition, administrative controls governing the conduct of normal work activities require that general visual observations indicating evidence of boric acid leakage or potential boric acid leakage be entered into the site corrective action program.

Scope and Extent of Coverage
WCNOC's boric acid corrosion inspection (BACINS) program includes identifying and evaluating leakage or potential leakage from 100% of the RCPB (ASME, Section III, Class I). The BACINS program requires a periodic examination of a specific list of potential sources of boric acid leakage in the RCPB. The coverage in this inspection includes all accessible RCPB piping and components except for under the reactor pressure vessel (RPV) lower head and the RPV loop nozzles inside the primary shield wall. All evidence of boric acid leakage identified during these examinations, or any other evidence of boric acid leakage is evaluated under the BACINS program.

The RCPB, including Alloy 600/82/182 materials, is also examined for pressure boundary leakage in accordance with ASME Section XI Code requirements. The coverage for this inspection includes visual examination of the bottom of the reactor pressure vessel through an access port in the insulation. In addition to ASME Section XI evaluation requirements, administrative controls require that any evidence of boric acid leakage identified during the examination process be documented and evaluated under the BACINS program.

RPV support pad examinations are performed during each ASME Section XI Inservice Inspection (ISI) program period. It is WCNOC's practice to visually observe the RPV loop nozzles inside the primary shield wall during this inspection. However, this observation is not currently included in the BACINS program administrative controls. WCNOC will revise the BACINS program to require a visual observation of the reactor pressure vessel loop nozzles inside the primary shield wall. This program revision will be completed by June 5, 2003.

Administrative controls governing the conduct of normal work activities require documentation of general visual observations that indicate evidence of boric acid leakage or potential boric acid leakage. The work controls process requires that evidence of potential boric acid leakage to be evaluated under the administrative controls of the BACINS program.

Frequency of Inspections
A specific inspection for evidence of boric acid leakage, controlled by WCNOC procedure STN PE-040D, "BACINS Walkdown for RCS Pressure Boundary Integrity," is performed at the beginning of each refueling outage. The ASME Section XI Code pressure boundary examinations, including examination of the RPV lower head, are performed at the end of every refueling outage. Also, ASME Code requires any time mechanical connections or bolted connections are breached, a post maintenance test for leakage be performed. As stated above, the RPV loop nozzles inside the primary shield wall are visually observed each ISI period during RPV support pad examinations.

Personnel Qualifications
BACINS walkdowns and ASME Code pressure boundary examinations are performed by VT-2 qualified examiners. Requirements for VT-2 qualification are in accordance with ANSI/ASNT CP-189, 1995 Edition, as amended in ASME Section XI, paragraph IWA-2310, 1995 Edition with 1996 amendment. ASME Visual examination (VT-2) techniques are recognized by the industry as being effective for identification of leakage. VT-2 techniques include requirements

for personnel qualification (training, visual acuity, etc.), illumination and access. CP-189 is a recognized industry standard for qualification and certification of nondestructive testing personnel.

Degree of Insulation Removal
Insulation is not removed for examination of the RCPB with the following exceptions. The basis for acceptability of conducting visual examinations for identifying boric acid leakage with insulation in place is included in the response to question 2 below.

1. Bolted connections: RCPB bolted connections within the ASME Code Section XI Inservice Inspection boundaries receive an inspection for boric acid residue with the insulation removed.

2. Dissimilar metal welds: In accordance with ASME Section XI requirements, dissimilar metal welds, including 82/182 welds, when performing nondestructive examination (NDE) from the outside diameter (OD), are examined with the insulation removed.

3. Evidence of potential boric acid leakage: If leakage or evidence of leakage (e.g., wetted surfaces or boric acid crystals) is identified during the conduct of BACINS walkdown examinations, ASME Code pressure boundary examinations, or incidental observation, WCNOC administrative controls require identification of the source of the leakage as well as inspection of any components affected by the leakage. WCNOC will enhance existing administrative controls by revising the BACINS program to specifically require insulation removal, if insulation removal is necessary to identify the source of the leakage and perform associated inspections. This revision will be complete by June 5, 2003.

Inspection of locations where leaks have the potential to degrade RCPB components
The use of carbon steel materials and components is limited by design at Wolf Creek Generating Station (WCGS) in locations where leaks have the potential to contact and degrade RCPB components. The reactor vessel, pressurizer vessel, pressurizer manways, steam generators, and steam generator manways are constructed of carbon steel with stainless steel clad. The reactor vessel closure studs, the pressurizer and steam generator manway bolting, and the reactor coolant pump main flange bolting are carbon steel. Leakage of reactor coolant that could potentially come into contact with these components is identified during the BACINS and ASME Section XI inspections as described above.

RAI Question

2. **"Provide the technical basis for determining whether or not insulation is removed to examine all locations where conditions exist that could cause high concentrations of boric acid on pressure boundary surfaces or locations that are susceptible to primary water stress corrosion cracking (Alloy 600 base metal and dissimilar metal Alloy 82/182 welds). Identify the type of insulation for each component examined, as well as any limitations to removal of insulation. Also include in your response actions involving removal of insulation required by your procedures to identify the source of leakage when relevant conditions (e.g., rust stains, boric acid stains, or boric acid deposits) are found."**

WCNOC Response

Technical basis for insulation removal
Insulation is removed to access metal surfaces for ISI weld inspections, from bolted connections during ISI pressure testing, and for identifying boric acid leakage sources and examination of components potentially affected by those leaks.

The basis for not removing the insulation during visual VT-2 examination is industry experience. It is expected that any significant leakage would migrate through the insulation and evidence would exist in the form of water or boron residue on the outside of the insulation. For the small type of leakage that is associated with a through wall pipe crack, indication might not be evident until a later time (e.g., the ASME pressure boundary examinations during the subsequent refueling outage). In such cases, a leak rate as low as 0.001 gallons per minute would result in an estimated three cubic feet (or 21.6 pounds) of boron residue during a typical fuel cycle. A volume of three cubic feet is large enough to be evident with insulation in place. The boric acid crystals would be identified during subsequent VT-2 examinations, if not noted first by station personnel as part of watchstation tours, entry inspections, and other observations.

Type of Insulation and Limitations to Removal
Reflective insulation consisting of an inner and outer casing of type 304 stainless steel with inner radiation shields of stainless steel surround the reactor vessel. The insulation is designed to be removable and reusable. This insulation is known as MIRROR insulation and is used for insulated components in the reactor cavity. Alloy 600 components and components with 82/182 welds in the reactor cavity include the reactor vessel (control rod drive mechanism and head vent penetrations and bottom mounted instrumentation penetrations) and the reactor vessel hot leg and cold leg nozzles.

For piping/components outside the reactor cavity, the insulation is in the form of quilted, light-density, semi-rigid fibrous glass encapsulated in a woven glass fiber fabric forming a composite blanket. The "blankets" are covered with stainless steel jacketing. The insulation system is known as NUKON insulation and, like the MIRROR insulation, is designed to be removable and reusable.

Location of Material Susceptible to Primary Water Stress Corrosion Cracking

Alloy 600 base metal used as pressure boundary material in Class 1 applications:

Component	Application	Insulation removed (for visual examination)
RPV lower head	penetration nozzles	Yes
RPV flange leak detection system	tubing	No (Normally dry and depressurized)

Alloy 82/182 weld metal utilized in pressure boundary applications:

Component	Configuration	Insulation removed (for visual examination)
RPV hot leg nozzles	safe-end welds	No (Access available through cavity seal ring manways)
RPV cold leg nozzles	safe-end welds	No (Access available through cavity seal ring manways)
RPV flange tell-tale drain	buttering and welds	No (Note 1)
RPV Lower Head nozzles	J-groove welds	No (Access available through cover in lower part of insulation)
Pressurizer safety and relief nozzles	buttering and safe-end to buttering weld	No (Note 1)
Pressurizer spray nozzle	buttering and safe-end to buttering weld	No (Note 1)
Pressurizer surge nozzle	buttering, safe-end to buttering weld and thermal sleeve to build up weld	No (Note 1)
Steam Generator bowl drains	carbon steel to stainless steel coupling weld	No (Note 1)

Note 1: The basis for not removing insulation is described in the response to question 2 above.

RAI Question

3. **"Describe the technical basis for the extent and frequency of walkdowns and the method for evaluating the potential for leakage in inaccessible areas. In addition, describe the degree of inaccessibility, and identify any leakage detection systems that are being used to detect potential leakage from components in inaccessible areas."**

WCNOC Response

Inaccessible Areas
There are no areas of the RCPB considered to be inaccessible for the performance of BACINS walkdowns and ASME Section XI inspections described above.

Technical basis for extent and frequency of walkdowns
The extent and frequency of the examinations of the entire RCS pressure boundary, including areas where access is limited, is described in the response to question 1. High dose rates limit access of the bioshield area while at power. ASME Section XI mandates a refueling frequency for examination of the RCPB.

RAI Question

4. **"Describe the evaluations that would be conducted upon discovery of leakage from mechanical joints (e.g., bolted connections) to demonstrate that continued operation with the observed leakage is acceptable. Also describe the acceptance criteria that was established to make such a determination. Provide the technical basis used to establish the acceptance criteria. In addition,**
   a. **if observed leakage is determined to be acceptable for continued operation, describe what inspection/monitoring actions are taken to trend/evaluate changes in leakage, or**
   b. **if observed leakage is not determined to be acceptable, describe what corrective actions are taken to address the leakage."**

WCNOC Response

Evaluation of leakage from bolted connections
The requirements of ASME Section XI, IWA-5250 and Relief Request I2R-02 are applied to bolted connections where leakage is identified during a pressure test.

Administrative controls for leakage evaluation
Identified boric acid leaks are evaluated in accordance with the requirements of WCNOC procedure AP 16F-001, Boric Acid Corrosion Inspection (BACINS) Program. Administrative controls include evaluation requirements to address continued plant operation, inspection, monitoring, and final corrective action. WCNOC's practice is to follow the guidance contained in the EPRI Boric Acid Corrosion Guidebook, Rev 1 (Reference 2). However existing administrative controls do not include specific requirements and instructions for evaluation of observed boric acid leaks.

WCNOC will revise administrative controls to provide specific instructions for evaluation of boric acid leakage. Administrative controls will include instructions for demonstrating acceptability of continued operation with leakage, acceptance criteria for continued operation, inspection and monitoring actions and actions required if leakage is not acceptable. Controls will be based on the guidance contained in the EPRI Boric Acid Corrosion Guidebook, Rev 1, where applicable. This revision will be completed by June 5, 2003.

RAI Question

5. **"Explain the capabilities of your program to detect the low levels of reactor coolant pressure boundary leakage that may result from through-wall cracking in the bottom reactor pressure vessel head incore instrumentation nozzles. Low levels of leakage may call into question reliance on visual detection techniques or installed leakage detection instrumentation, but has the potential for causing boric acid corrosion. The NRC has had a concern with the bottom reactor pressure vessel head incore instrumentation nozzles because of the high consequences associated with loss of integrity of the bottom head nozzles. Describe how your program would evaluate evidence of possible leakage in this instance. In addition, explain how your program addresses leakage that may impact components that are in the leak path."**

WCNOC Response

Low Level RCS Leakage Detection and Evaluation
As described in the response to question 1, the lower reactor pressure vessel head is visually inspected each refueling outage during the ASME pressure boundary inspection. Any evidence of boric acid leakage in the lower head penetrations would require characterization of the source of the leakage. This characterization could include, but is not limited to, Non-destructive Examination (NDE) techniques such as Ultrasonics (UT) or Eddy Current (ET) testing. If these examination techniques verified RCPB leakage, actions would be taken in accordance with ASME Section XI repair and replacement requirements.

Installed instrumentation for leakage detection includes gaseous and particulate radiation monitors, containment sump level instruments, containment cooler condensation level instrumentation and humidity sensors. However, these systems are designed to identify a minimum leak rate of approximately one gallon per minute (gpm). These systems are not capable of reliably detecting small RCS leaks.

Industry and WCGS experience indicate that leakage inside containment of much less than one gpm can be detected and trended using containment atmosphere monitoring and other installed instrumentation. To ensure adverse trends are appropriately addressed, WCNOC will revise administrative controls for monitoring and evaluating the containment atmosphere to require initiation of corrective action documentation when sample results indicate potential RCS leakage or changes to RCS leakage. WCNOC will also revise administrative controls for RCS leakage rate calculations to initiate corrective action documentation when the RCS leak rate increases and the cause cannot be determined. These revisions will be completed by June 5, 2003. WCNOC's current corrective action program requires a corrective action document when a deficiency contributing to RCS leakage is identified.

Leak Path Components
Components in the leak path are inspected for effects of boric acid corrosion. If corrosion is identified, new corrective actions are initiated to evaluate the affected component in accordance with the station corrective action program.

RAI Question

6. **"Explain the capabilities of your program to detect the low levels of reactor coolant pressure boundary leakage that may result from through-wall cracking in certain components and configurations for other small diameter nozzles. Low levels of leakage may call into question reliance on visual detection techniques or installed leakage detection instrumentation, but has the potential for causing boric acid corrosion. Describe how your program would evaluate evidence of possible leakage in this instance. In addition, explain how your program addresses leakage that may impact components that are in the leak path."**

WCNOC Response

Low Level RCS Leakage Detection and Evaluation
The primary means for detecting low level RCPB leakage (i.e., leakage significantly less than one gpm) that has the potential to significantly degrade RCPB components are described in the response to question 5 above. In addition, industry and WCGS operating experience indicates installed instrumentation would be capable of detecting levels of leakage much less than one gpm. Any evidence of boric acid leakage would require characterization of the source of the leakage. This could include, but is not limited to, Non-destructive Examination (NDE) techniques such as Ultrasonics (UT) or Eddy Current (ET) testing. If these examination techniques verify RCPB leakage, actions would be taken in accordance with ASME Section XI repair and replacement requirements.

Leak Path Components
As described above, components in the leak path are inspected for effects of boric acid corrosion. If corrosion is identified, new corrective actions are initiated to evaluate the affected component in accordance with the station corrective action program.

RAI Question

7. **"Explain how any aspects of your program (e.g., insulation removal, inaccessible areas, low levels of leakage, evaluation of relevant conditions) make use of susceptibility models or consequence models."**

WCNOC Response

Susceptibility and consequence models are not utilized in BACINS or ASME pressure boundary inspection programs. The EPRI Risk-Informed Inservice Inspection has been implemented for Class 1 butt welds (Category B-F and B-J), but applies only to volumetric examinations (UT).

RAI Question

8. **"Provide a summary of recommendations made by your reactor vendor on visual inspections of nozzles with Alloy 600/82/182 material, actions you have taken or plan to take regarding vendor recommendations, and the basis for any recommendations that are not followed."**

WCNOC Response

Westinghouse did not identify any recommendations applicable to WCGS on visual inspections of Alloy 600/82/182 locations. (Reference 3)

RAI Question

9. **"Provide the basis for concluding that the inspections and evaluations described in your responses to the above questions comply with your plant Technical Specifications and Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55(a), which incorporates Section XI of the American Society of Mechanical Engineers (ASME) Code by reference. Specifically, address how your boric acid corrosion control program complies with ASME Section XI, paragraph IWA-5250(b) on corrective actions. Include a description of the procedures used to implement the corrective actions."**

WCNOC Response

Basis

WCNOC complies fully with ASME Section XI, 1989 Edition as required by 10 CFR 50.55a. WCNOC's BACINS program was developed to identify, evaluate and correct boric acid leakage. IWA-5250 applies to leakages identified in the performance of pressure tests (see ASME Section XI interpretation XII-1-92-03); however, the intent of this paragraph is incorporated in the evaluation required by WCNOC procedure AP 16F-001, which requires documentation and evaluation of the depth and extent of any boric acid corrosion. This evaluation will determine whether adequate wall thickness remains for continued service, or whether repair or replacement is required. Procedure AP 16F-001, as described above, contains applicable actions to ensure compliance with IWA-5250(b) and Technical Specifications.

References

1. ET 02-0021, dated May 16, 2002, from Gary B. Fader, WCNOC, to USNRC, 60-Day Response to NRC Bulletin 2002-01 "Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity"

2. Boric Acid Corrosion Guidebook, Revision 1: Managing Boric Acid Corrosion Issues at PWR Power Stations, EPRI, Palo Alto, CA, 2001, 1000975

3. WOG–02-223, "Transmittal of Response to NRC Request for Information, Bulletin 2002-01: Vendor Recommendations for Visual Inspections of Alloy 600/82/182 Component Locations (MHUP-5035, CEOG 2046)"

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 revise the boric acid corrosion inspection program to require a visual examination of the reactor pressure vessel loop nozzles inside the primary shield wall.	June 5, 2003
WCNOC will enhance existing administrative controls by revising the BACINS program to specifically require insulation removal, if insulation removal is necessary to identify the source of the leakage and perform associated inspections.	June 5, 2003
WCNOC will revise administrative controls to provide specific instructions for evaluation of boric acid leakage. Administrative controls will include instructions for demonstrating acceptability of continued operation with leakage, acceptance criteria for continued operation, inspection and monitoring actions and actions required if leakage is not acceptable. Controls will be based on the guidance contained in the EPRI Boric Acid Corrosion Guidebook, Rev 1, where applicable.	June 5, 2003
WCNOC will revise administrative controls for monitoring and evaluating the containment atmosphere to require initiation of corrective action documentation when sample results indicate potential RCS leakage or changes to RCS leakage.	June 5, 2003
WCNOC will revise administrative controls for RCS leakage rate calculations to initiate corrective action documentation when the RCS leak rate increases and the cause cannot be determined.	June 5, 2003