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10 CFR 2.201

July 28, 2006  
BW060078

U. S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, DC 20555-0001

Braidwood Station, Units 1 and 2  
Facility Operating License Nos. NPF-72 and NPF-77  
NRC Docket Nos. 50-456 and 50-457

Subject: Reply to Notice of Violation: EA-06-081

Reference: Letter from James L. Caldwell (NRC) to Christopher M. Crane (EGC), "Final Significance Determination for a White Finding and Notice of Violation (NRC Inspection Report 05000456/2006012; 05000457/ 2006012 (DRS)); Braidwood Nuclear Power Plant, Units 1 and 2," dated June 29, 2006

In the referenced letter, the NRC provided Exelon Generation Company, LLC (EGC) with the final significance determination for the inspection activities completed on May 25, 2006.

As a result of the inspection, the NRC identified three violations of NRC requirements. The violations resulted from multiple failures to adequately evaluate the radiological hazards associated with the leaks from the circulating water blowdown line vacuum breakers and to assess the environmental impact of the resultant onsite and offsite tritium contamination. Attachment 1 provides our reply to the Notice of Violation. Attachment 2 provides a list of commitments made in the reply to the Notice of Violation. If you have any questions concerning this letter, please contact Mr. Dale Ambler, Regulatory Assurance Manager, at (815) 417-2800.

Respectfully,



Keith J. Polson  
Site Vice President  
Braidwood Station

Attachment: 1. Reply to Notice of Violation  
2. List of Commitments

## **Reply to Notice of Violation: EA-06-081**

### **Violation No. 1:**

“10 CFR 20.1501 requires that each licensee make, or cause to be made, surveys that may be necessary for the licensee to comply with the regulations in Part 20 and that are reasonable under the circumstances to evaluate the extent of radiation levels, concentrations or quantities of radioactive materials, and the potential radiological hazards that could be present. Pursuant to 10 CFR 20.1003, *survey* means an evaluation of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal, or presence of radioactive material or other sources of radiation.

10 CFR 20.1301 requires the licensee to conduct operations so that the total effective dose equivalent to individual members of the public from the licensed operation does not exceed 0.1 rem (1 mSv) in a year.

Contrary to the above, as of March 2006, the licensee did not make surveys to assure compliance with 10 CFR 20.1301, which limits radiation exposure to 0.1 rem. As examples, in November 1996 and December 1998, failed vacuum breakers in the licensee's radioactive waste discharge line resulted in large volumes of liquid contaminated with radioactive material to leak in an uncontrolled manner to the unrestricted areas. Following identification of the leaks of radioactive material, the licensee failed to perform adequate surveys to identify the extent of radiation and contamination levels and the potential hazards associated with the radioactive material and to take actions necessary to control the material.”

### **RESPONSE:**

#### **1. The reason for the violation.**

An investigation was performed to determine the root cause(s) of the inadequate response to unplanned environmental tritium releases from Braidwood Station. The investigation by the Root Cause Team determined that the inadequate response was due to a lack of integrated procedural guidance and weak managerial oversight.

#### **2. The corrective steps that have been taken and results achieved.**

Identification of tritium above background concentrations in the perimeter ditch on the east side of the Braidwood Station property prompted a series of groundwater studies in the Summer and Fall of 2005. A comprehensive groundwater investigation program was implemented in mid-November 2005. As part of the groundwater studies, and the overall site characterization program, Exelon Generation Company, LLC (EGC) has installed over 300 groundwater monitoring points at the site to date, collected surface water samples, and sampled private wells on many occasions. A routine monitoring program of private well sampling and groundwater monitoring is currently on-going at the site. Over 1300 samples

have been collected to date and analyzed. Figures showing groundwater monitoring and private well locations, as well as various ponds around the site, were provided in a letter from Keith J. Polson to the U.S. NRC, "2005 Radioactive Effluent Release Report," dated April 28, 2006. Groundwater monitoring initiated in 2005 determined the extent and concentration of tritium in groundwater plumes originating at vacuum breaker (VB) 1, VB-2, VB-3 and smaller plumes originating at VB-4, VB-6, and VB-7. Note that no tritium has been detected in offsite groundwater around VB-5, VB-8, VB-9, VB-10, and VB-11. The results of this monitoring have been documented in reports submitted to the Illinois Environmental Protection Agency (IEPA) in letters from Keith J. Polson (EGC) to Beverly Booker (IEPA), "Braidwood Station Site Investigation Report," dated March 24, 2006 and Kenneth A. Ainger (EGC) to Richard P. Cobb (IEPA), "Braidwood Station Site Investigation Reports," dated May 1, 2006.

An assessment of offsite doses from inadvertent releases of water from the Circulating Water (CW) blowdown line has since been performed and provided as Attachment 2 in a letter from Keith J. Polson to the U.S. NRC, "2005 Radioactive Effluent Release Report," dated April 28, 2006. The report assesses the potential offsite radiation doses that could have been received by members of the public from exposure to tritium that reached the offsite environment around the Braidwood Station.

Evaluation of potential exposures from the VB releases utilizing the guidance in Regulatory Guide (RG) 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, assuming conservative scenarios showed all potential doses to be very low. None of the bounding scenarios resulted in a dose over 0.3 mrem/yr or 0.3 mrem per event in any reconstructed, current, or hypothetical future scenarios. These bounding dose estimates are a small percentage of the 6 mrem/yr design objective for the site presented in 10 CFR 50, Appendix I, and even further below the 100-mrem/yr regulatory limit in 10 CFR 20.

The maximum realistic dose was estimated utilizing the tritium dose factors in NUREG/CR-4013, "LADTAP II – Technical Reference and User's Guide," dated April 1986, and was determined to be 0.072 mrem/yr. The maximum realistic estimate is only 1.2 percent of the 6-mrem/yr design objective in 10 CFR 50, Appendix I, and 0.07 percent of the 10 CFR 20 limit.

### **3. The corrective steps that will be taken to avoid further violations.**

To avoid further violations, corrective actions associated with the root causes were identified. To address the first root cause of the inadequate response to unplanned tritium releases identified as lack of integrated procedural guidance, integrated procedures are being developed and will be implemented to provide integrated and detailed spill and leak response requirements to ensure full compliance with State and Federal laws and regulations and integrate EGC resources to respond to radiological leaks and spills. More specifically, the integrated spill procedures will provide discussion and direction on the requirements to respond to the unplanned release of radioactively contaminated liquids onto the ground from which it might

flow or drain to soils, groundwater or surface water. These procedures will also document the ownership and responsibilities for facility and corporate workgroups with regards to controlling and stopping the event, quantifying the environmental impact, containing the spill and determining remediation and communication of the event. The development and implementation of a set of integrated procedures will be completed by August 31, 2006. This is identified as a commitment in Attachment 2.

To address the second root cause for the ineffective response to unplanned tritium releases identified as weak management review and oversight, Human Performance procedures HU-AA-102, "Technical Human Performance Practices," and HU-AA-1212, "Technical Task Risk/Rigor Assessment, Pre-Job Brief, Independent Third Party Review, and Post-Job Brief," have been instituted to improve technical rigor, questioning attitude, and attention to detail. In addition, Administrative Operating Procedure OP-AA-106-101-1002, "Exelon Nuclear Issues Management," has also been revised to: 1) improve Corrective Action Program (CAP) controls of Issues Management teams, 2) utilize the tools and techniques of the Exelon Human Performance Procedures HU-AA-102 and HU-AA-1212, 3) strengthen reporting requirements to station Senior Management, and 4) define station Senior Management responsibilities for oversight and challenge of events and issues from initial identification to final disposition.

**4. The date when full compliance will be achieved.**

Braidwood Station achieved full compliance with the requirements of 10 CFR 20.1501 and 10 CFR 20.1301 based on the submittal of a letter from Keith J. Polson (EGC) to U.S. NRC, "2005 Radioactive Effluent Release Report," dated April 28, 2006. The necessary surveys were performed and the offsite dose to a member of the public was assessed based on conservative assumptions. The assessment concluded that potential exposure from the VB releases using conservative exposure scenarios resulted in very low doses and were estimated to be well within the regulatory limit of 0.1 rem per year specified in 10 CFR 20.1301.

**Violation No. 2:**

“Technical Specification 6.8.4.e requires, in part, that the cumulative dose contributions from liquid effluents for the current calendar quarter and the current calendar year be determined in accordance with the methodology and parameters in the Offsite Dose Calculation Manual (ODCM) at least once per 31 days.

Contrary to the above, between November 1996 and March 2006, the licensee did not determine the cumulative dose contributions from liquid effluents inadvertently leaked to on-site and off-site locations resulting from failed vacuum breakers along the radioactive waste discharge line in 1996, 1998, and 2000 in accordance with the methodology and parameters in the ODCM within 31 days of the leaks. Specifically, the licensee did not determine the dose resulting from a: 1) November 1996 release from a Vacuum Breaker No. 1 leak of 250,000 gallons of water that included radioactive material to the groundwater pathway; 2) December 1998 release from a Vacuum Breaker No. 3 leak of 3 million gallons of water that included radioactive material to the ground water pathway; and 3) November 2000 release from a Vacuum Breaker No. 2 leak of 3 million gallons of water that included radioactive material to the groundwater pathway.”

**RESPONSE:**

**1. The reason for the violation.**

As described in the response to Violation No. 1, an investigation was performed to determine the root cause(s) of the inadequate response to unplanned environmental tritium releases from Braidwood Station. The investigation by the Root Cause Team determined that the inadequate response was due to a lack of integrated procedural guidance and weak managerial oversight.

**2. The corrective steps that have been taken and results achieved.**

As described in the response to Violation No. 1, an assessment of offsite doses from inadvertent releases of water from the CW blowdown line has since been performed and provided as Attachment 2 in a letter from Keith J. Polson (EGC) to U.S. NRC, “2005 Radioactive Effluent Release Report,” dated April 28, 2006. The report assesses the potential offsite radiation doses that could have been received by members of the public from exposure to tritium that reached the offsite environment around the Braidwood Station. The assessment included a conservative estimate utilizing the guidance in RG 1.109 and a more realistic estimate using assumptions and parameter values that more closely reflect the actual environmental conditions, characteristics, and lifestyles of nearby residents. Evaluation of realistic exposure scenarios included calculation of dose using the tritium dose factors from NUREG/CR-4013. These tritium dose factors are the basis for current Braidwood ODCM ingestion dose factors, instead of the more conservative RG 1.109 values.

Evaluation of potential exposures from the VB releases utilizing the guidance in RG 1.109 assuming conservative scenarios showed all potential doses to be very low.

None of the bounding scenarios resulted in a dose over 0.3 mrem/yr or 0.3 mrem per event in any reconstructed, current, or hypothetical future scenarios. These bounding dose estimates are a small percentage of the 6 mrem/yr design objective for the site presented in 10 CFR 50, Appendix I, and even further below the 100-mrem/yr regulatory limit in 10 CFR 20.

The maximum realistic dose was estimated utilizing the tritium dose factors in NUREG/CR-4013 and was determined to be 0.072 mrem/yr. The maximum realistic estimate is only 1.2 percent of the 6-mrem/yr design objective in 10 CFR 50, Appendix I, and 0.07 percent of the 10 CFR 20 limit.

**3. The corrective steps that will be taken to avoid further violations.**

As described in the response to Violation No. 1, to address the first root cause of the inadequate response to unplanned tritium releases identified as lack of integrated procedural guidance, integrated procedures are being developed and will be implemented to provide integrated and detailed spill and leak response requirements to ensure full compliance with State and Federal laws and regulations and integrate EGC resources to respond to radiological leaks and spills.

As described in the response to Violation No. 1, to address the second root cause for the ineffective response to unplanned tritium releases identified as weak management review and oversight, Human Performance procedures HU-AA-102, "Technical Human Performance Practices," and HU-AA-1212, "Technical Task Risk/Rigor Assessment, Pre-Job Brief, Independent Third Party Review, and Post-Job Brief," have been instituted to improve technical rigor, questioning attitude, and attention to detail. In addition, Administrative Operating Procedure OP-AA-106-101-1002, "Exelon Nuclear Issues Management," has also been revised to: 1) improve Corrective Action Program (CAP) controls of Issues Management teams, 2) utilize the tools and techniques of the Exelon Human Performance Procedures HU-AA-102 and HU-AA-1212, 3) strengthen reporting requirements to station Senior Management, and 4) define station Senior Management responsibilities for oversight and challenge of events and issues from initial identification to final disposition.

**4. The date when full compliance will be achieved.**

Braidwood Station has achieved compliance with the requirements of TS 6.8.4.e to determine the cumulative dose contributions from liquid effluents in accordance with the methodology and parameters in the ODCM. The dose assessment was provided as Attachment 2 in a letter from Keith J. Polson (EGC) to U.S. NRC, "2005 Radioactive Effluent Release Report," dated April 28, 2006.

**Violation No. 3:**

“Technical Specification 6.9.1.6 requires, in part, that the Annual Radiological Environmental Operating Report include summaries, interpretations, and analyses of trends of the results of the radiological environmental monitoring program for the reporting period and that the material shall be consistent with the objectives outlined in the Offsite Dose Calculation Manual (ODCM), and in 10 CFR 50, Appendix I, Sections IV.B.2, IV.B.3, and IV.C.

10 CFR 50, Appendix I, Section IV.B.2 states the licensee shall establish an appropriate surveillance and monitoring program to provide data on measurable levels of radiation and radioactive materials in the environment to evaluate the relationship between quantities of radioactive material released in effluents and resultant doses to individuals from principal pathways of exposure.

Contrary to the above, as of March 2006, the licensee did not establish an appropriate surveillance and monitoring program to evaluate the relationship between quantities of radioactive material released in effluents and resultant doses to individuals from principal pathways of exposure. Specifically, the radioactive material released in the 1996, 1998, and 2000 vacuum breaker leaks constituted new principal pathways of exposure (i.e., the groundwater pathway) which the licensee had not adequately evaluated with the existing Radiological Effluent Monitoring Program (REMP).”

**RESPONSE:**

**1. The reason for the violation.**

As described in the responses to the previous Violations, an investigation was performed to determine the root cause(s) of the inadequate response to unplanned environmental tritium releases from Braidwood Station. The investigation by the Root Cause Team determined that the inadequate response was due to a lack of integrated procedural guidance and weak managerial oversight.

**2. The corrective steps that have been taken and results achieved.**

As described in the response to Violation No. 1, identification of tritium above background concentrations in the perimeter ditch on the east side of the Braidwood Station property prompted a series of groundwater studies in the Summer and Fall of 2005. A comprehensive groundwater investigation program was implemented in mid-November 2005. As part of the groundwater studies, and the overall site characterization program, EGC has installed over 300 groundwater monitoring points at the site to date, collected surface water samples, and sampled private wells on many occasions. A routine monitoring program of private well sampling and groundwater monitoring is currently on-going at the site. Over 1300 samples have been collected to date and analyzed. The Braidwood Station 2005 Radioactive Effluent Release Report includes figures showing groundwater monitoring and private well locations, as well as various ponds around the site.

Groundwater monitoring initiated in 2005 determined the extent and concentration of tritium in groundwater plumes originating on the site at VB-1, VB-2, VB-3 and smaller plumes originating at VB-4, VB-6, and VB-7. Note that no tritium has been detected in offsite groundwater around VB-5, VB-8, VB-9, VB-10, and VB-11. The results of this monitoring have been documented in reports submitted to the Illinois Environmental Protection Agency (IEPA) in letters from Keith J. Polson (EGC) to Beverly Booker (IEPA), "Braidwood Station Site Investigation Report," dated March 24, 2006 and Kenneth A. Ainger (EGC) to Richard P. Cobb (IEPA), "Braidwood Station Site Investigation Reports," dated May 1, 2006.

**3. The corrective steps that will be taken to avoid further violations.**

As a result of the final characterization of the radiological spills that occurred between 1996 and 2006, additional monitoring points to properly evaluate the relationship between quantities of radioactive material released in effluents and resultant doses to individuals from principal pathways of exposure have been identified. The REMP will be revised to include the additional necessary monitoring points. This is identified as a commitment in Attachment 2 and will be completed by September 29, 2006.

**4. The date when full compliance will be achieved.**

Braidwood Station will achieve full compliance upon revising the REMP to include additional necessary monitoring points. This is scheduled to be completed by September 29, 2006.

Attachment 2  
List of Commitments

The following table identifies commitments made in this document by Braidwood. Any other actions discussed in the submittal represent intended or planned actions. They are described to the NRC for the NRC's information and are not regulatory commitments.

COMMITMENT	COMMITTED DATE OR "OUTAGE"	COMMITMENT TYPE	
		ONE-TIME ACTION (Yes/No)	PROGRAMMATIC (Yes/No)
Develop and implement integrated procedures to provide integrated and detailed spill and leak response requirements and integration of EGC resources to respond to radiological leaks and spills.	August 31, 2006	Yes	No
Revise the Radiological Environmental Monitoring Program (REMP) to include additional necessary monitoring points to properly evaluate the relationship between quantities of radioactive material released in effluents and resultant doses to individuals from principal pathways of exposure have been identified.	September 29, 2006	Yes	No