March 9, 2006

Braidwood Tritium Contamination
Questions and Answers

Q1. How did the tritium get into the groundwater at the Braidwood Nuclear Plant?

A1. The licensee attributes the tritium in the groundwater to past leakage from a discharge pipe which normally carries non-radioactive circulating water discharge to the Kankakee River. The discharge pipe is also used for planned liquid radioactive effluent releases with the effluent mixing with the circulating water being discharged. Braidwood, like most nuclear plants, releases small concentrations of radioactive liquids under controlled and monitored conditions and within limits imposed by the NRC. Planned radioactive liquid effluent releases were made at the times when the circulating water discharge piping was subsequently found to be leaking through installed vacuum breaker valves, which accounts for the presence of tritium in the ground. As with any liquid introduced into the ground, the substance flows in a direction consistent with the hydrologic characteristics of the area and ultimately into the groundwater aquifer.

Q2. What is the NRC doing in response to the tritium contamination?

A2. NRC Region III initially dispatched a Senior Radiation Specialist to the site to assist the Resident Inspectors in their review of the circumstances surrounding the elevated measurements and the licensee's plans to address the elevated tritium levels. The NRC's onsite inspection has focused on the licensee's current and historical actions, and the NRC expects to release a report of that inspection in early April 2006.

NRC Region III has contracted with its vendor to perform laboratory analyses of water samples that were either independently collected or were obtained through split sampling with the licensee. The analyses were performed to independently validate the licensee contractors' laboratory sample results. The samples that were analyzed and/or collected by the NRC included residential well samples and monitoring wells (both onsite and offsite).

NRC Region III continues to monitor and review the licensee's investigation and response to the elevated tritium samples.

Q3. What is the health hazard to the public? Potential dose?

A3. Initial measurement results from onsite shallow well samples indicate concentrations of tritium at a fraction of the NRC limits for radioactive liquid effluent releases to the environment. Initial data provided by the licensee (and verified by the NRC's independent measurements) indicates background levels of tritium in near site residence wells, with the exception of one well. That excepted well is relatively shallow (less than 30 feet), and tritium concentrations measure approximately 1500-2000 picocuries/liter. The tritium concentration present in that shallow well is approximately 10 percent of the EPA drinking water standard of 20,000 picocuries/liter. Over 40 residential wells have been tested.

The licensee is evaluating the potential dose to members of the public from the tritium in the ground water. When that evaluation is completed, the NRC will review it to determine if it is adequate. However, based on the levels of tritium detected in the groundwater to date, it does not appear that any NRC limits will be exceeded.

Q4. Is the leak continuing? Is there anything that can be done to stop the contamination from moving offsite?

A4. The licensee suspended radioactive releases through the blowdown line on November 23, 2005, and there is no indication of continuing leakage. Some sample data indicates off-site migration north of the licensee's restricted area (owner controlled area). The licensee has hired hydrologists and geologists to assess the situation. The licensee is developing various mitigation strategies to reduce the impact of the contamination.

Q5. Is the water safe to drink?

A5. Although one residential well has been identified with tritium above background levels, the levels are significantly lower than the EPA drinking water standard. Consequently, offsite drinking water sources are not contaminated with tritium to levels that would pose a health hazard.

Q6. Is the water being tested for other contaminants?

A6. The licensee's sampling and analysis is limited to radioactive contaminants. Groundwater samples collected by the licensee and split with the NRC are being analyzed for tritium and, in some cases, gross gamma activity. Based on these analyses, no other radioactive contaminants have been detected.

Q7. What's being done to keep this from happening again?

A7. The licensee is in the process of investigating this event to determine the cause. Once this investigation is complete, the licensee will develop and implement corrective actions. **The licensee has also provided a commitment to discuss with the NRC any proposed liquid discharge pathways prior to commencing any liquid radioactive discharges to the environment** (ADAMS ML060670040 and ML060660590). The NRC is in the process of reviewing and evaluating the adequacy of the licensee's investigation and will monitor the effectiveness of the corrective actions.

Q8. Is the tritium offsite? Bounded?

A8. The licensee has measured tritium (about 2400 picocuries per liter) in an offsite pond on a vacant parcel of land and up to 226,000 picocuries per liter in a monitoring well between the pond and the site boundary. These measurements were verified by the NRC's independent measurements. The licensee is currently developing an analysis to bound the offsite dose from the migration of the contamination. At the same time, the licensee is developing plans to potentially remediate some of the groundwater contamination.

Q9. What is the NRC limit? How was the limit created?

A9. The requirements in 10 CFR Part 20 state that each licensee shall conduct operations so that the total effective dose equivalent to individual members of the public from the licensed operations does not exceed 0.1 rem (100 millirem) in a year, which the licensee can demonstrate by not exceeding the concentration values specified in Table 2 of Appendix B to 10 CFR Part 20 when averaged over the course of a year. For tritium, the Table 2 effluent concentration value is $1x10^{-3}$ micocuries per milliliter ($1x10^{6}$ picocuries per liter). The consumption of water containing this maximum concentration of tritium over a one year period, equates to a dose of 0.05 rem (50 millirem).

Furthermore, 10 CFR Part 20 requires that licensees comply with EPA's environmental radiation standards contained in 40 CFR Part 190, i.e., 25 millirem to the whole body, 75 millirem to the thyroid, and 25 millirem to any other organ of any member of the public as the result of exposures to planned discharges of radioactive materials from uranium fuel cycle operations, which includes nuclear power plants, and to radiation from these operations.

The NRC also has design objectives in Appendix I to 10 CFR Part 50 to meet the criterion of As-Low-As-Is-Reasonably-Achievable (ALARA) for reactor effluents. The design objectives for liquid effluent releases is to maintain offsite annual doses below 3 millirem to the whole body and 10 millirem to any organ. Power reactors have license conditions such that if half of those radiation dose levels are exceeded in any calendar quarter, licensees are to investigate the cause(s), initiate a corrective action program, and report the actions within 30 days from the end of the quarter to the NRC. In addition, power reactors have license conditions such that 30 day reports are also made if environmental sample results exceed specified levels of radioactivity.

Q10. What is the EPA drinking water limit?

A10. The EPA has a maximum contamination level (MCL) of 4 millirem per year for beta particle and photon radioactivity from man-made radionuclides in drinking water. If contamination is exclusively tritium, this EPA drinking water standard corresponds to a concentration of 20,000 picocuries per liter of tritium, which is based on an annual dose of 4 millirem.

Q11. What are the NRC sanctions?

A11. The NRC will fully evaluate the licensee's actions with respect to the applicable regulatory requirements (license provisions, Technical Specifications, and 10 CFR Parts). If violations of NRC requirements are identified, the NRC will take enforcement actions consistent with the Reactor Oversight Program and the NRC Enforcement Policy.

Q12. What will the NRC require the licensee to do about the tritium?

A12. The licensee must make radiological surveys/evaluations and dose assessments as required by its NRC license and other applicable regulatory requirements. The NRC will ensure that the licensee has clearly demonstrated the integrity of the discharge line or any other **radioactive liquid** release path before it is used for liquid radwaste discharges.

In addition, if there is evidence which shows that the NRC's public dose limits may be exceeded, the NRC can require the licensee to take additional actions, including remediation, to minimize the potential impact.