June 28, 2006

The Honorable Edward J. Markey
United States House of Representatives
Washington, D.C. 20515

Dear Congressman Markey:

On behalf of the U.S. Nuclear Regulatory Commission (NRC), I am responding to your letter dated March 8, 2006, regarding radioactive liquid releases from nuclear power reactors. In your letter, you request that the NRC take eight specific actions. Detailed responses to the issues you raised are provided in Enclosure 1, including a list of leaks of tritium by NRC licensees over the past years. Based on current information, none of these events have resulted in exposures exceeding NRC or EPA regulatory dose limits for members of the public, and all have typically been very small fractions of the limits.

Additionally, the NRC has completed its initial inspection of the circumstances surrounding historical leaks and the resulting groundwater contamination at the Braidwood nuclear power plant site. The NRC baseline inspection report for the Braidwood Nuclear Power Plant is included for your convenience as Enclosure 2.

In your letter, you also raise several concerns regarding potential increases in local cancer rates in the State of Illinois. The Illinois Department of Public Health has examined pediatric cancer incidence and mortality in the vicinity of nuclear power plants in the State. The study was conducted under a Cooperative Agreement with the U.S. Centers for Disease Control and Prevention and utilized data from the National Cancer Institute's Surveillance, Epidemiology, and End Results program for cancer mortality. The 2006 publication concluded in part that

> "*pediatric cancer incidence and mortality rates for NFCG (nuclear facility county group) or NFZG (nuclear facility ZIP code group) were not significantly different from those for their comparison groups. In addition, there was no evidence of increased trend in cancer incidence rate after startup of nuclear power plants*."

Numerous other agencies and organizations are continually studying the effects of low levels of radiation exposure. These include the National Academies of Science's recently published BEIR VII report, "Health Risks From Exposure to Low Levels of Ionizing Radiation." The BEIR VII report concludes that scientific evidence is consistent with the hypothesis that there is a linear, no-threshold dose-response relationship between exposure and cancer. Since the Braidwood dose assessment concluded that the public doses were very small and within NRC and EPA regulatory limits, the probability of cancer incidence is correspondingly very small. Thus, the NRC does not endorse funding a major epidemiological study of public health among residents living near Illinois nuclear power reactors.

I want to assure you that NRC has and will continue to exercise strong oversight of radiological safety programs at all nuclear power plants. If you have any questions regarding these matters, please contact Rebecca Schmidt, Director of the Office of Congressional Affairs, at 301-415-1776.

Sincerely,

/RA/

Nils J. Diaz

Enclosures:
1. Response to Congressman Edward J. Markey's Concerns on Radioactive Tritium Leaks
2. NRC Baseline Inspection Report for the Braidwood Nuclear Power Plant

Response to Congressman Edward J. Markey's
Concerns on Radioactive Tritium Leaks

1. Direct the U.S. Nuclear Regulatory Commission staff to undertake inspections of all reactors which may be at risk of leaking tritium, instead of focusing on reactors in Illinois alone.

The NRC is inspecting all U.S. nuclear power plants to assess whether similar unplanned and unmonitored releases have occurred. If releases are found, the NRC will review and assess the corrective actions taken by the associated licensees in response to these releases. The related NRC inspection reports and plant monitoring data will be made publicly available.

The NRC has also established a lessons-learned task force to address inadvertent, unmonitored liquid radioactive releases from U.S. commercial nuclear power plants. This task force will review previous incidents, identify lessons learned from these events, and determine what changes, if any, are needed to the regulatory program. The NRC will enter the findings from the lessons learned task force into its formal agency lessons learned program.

These actions are over and above the routine radiological inspections performed at all reactors. These inspections specifically investigate the safety and operation of the radioactive effluent and environmental monitoring programs, including potential sources of leaks and spills of radioactive material and the potential effects on the environment. Trained, qualified radiation specialists inspect each plant to observe and interview plant employees about the operations of the radioactive effluent and environmental monitoring programs. Each plant also has full-time resident inspectors stationed at the site to handle events on a daily basis.

NRC is committed to ensuring that its radioactive effluent and environmental inspections of all reactors in this country are thorough and comprehensive in order to verify reactor operation is conducted within the applicable NRC regulatory requirements.

2. Provide specific answers to the questions posed in my letter of January 19, 2005.

The following are more specific answers to the issues and questions posed in your January 19, 2005 letter and supplement our previous response to our letter dated March 7, 2005.

1. Has the infant mortality rate in Grundy County, Illinois, doubled between 1995 and 1999?

   The infant mortality rate has not doubled.
   Data source: http://www.idph.state.il.us/cancer/statistics.htm#O

   With the exception of 1995, there was no major change in the number of infant deaths in Grundy County (Table 1) between the years 1993 and 2003. Although the Illinois Department of Public Health (IDPH) did not calculate an annual mortality rate for the county because there were too few infant deaths to achieve a statistically reliable result, the infant mortality rate for Grundy County was assessed to be generally lower than the Statewide average. For example, from 1993 to 2003, the infant mortality rate in Grundy County was 7.5 deaths per 1,000 live births compared to 8.33 deaths statewide. From 1997 to 2003, the infant mortality rate in Grundy County was 6.35 deaths per 1,000 live births compared to 7.9 deaths Statewide.

Table 1. Infant Mortality Statistics

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Grundy County											
Infant Deaths	1	0	10	7	3	1	2	4	4	3	5
Live Births	445	458	477	500	458	453	503	493	484	483	591
Mortality Rate [1]	**	**	21	**	**	**	**	**	**	**	**
Illinois											
Infant Deaths	1,838	1,711	1,724	1,536	1,476	1,505	1,504	1,528	1,379	1,304	1,380
Live Births	190,709	189,182	185,801	183,079	180,649	182,503	182,027	185,003	184,022	180,555	182,393
Mortality Rate	9.6	9.3	9.3	8.4	8.2	8.2	8.3	8.3	7.5	7.2	7.6

[1] Infants deaths per 1,000 live births

** Rate does not meet standards of reliability or precision.

Data source: Illinois Department of Public Health http://www.idph.state.il.us/cancer/statistics.htm#O

2. Was there a 400% increase in pediatric cancer between 1995 and 1999?

   A representative of Illinois Department of Public Health (IDPH) described the 400 percent increase in pediatric cancer to be "technically accurate, but meaningless." The baseline data for pediatric cancer was chosen as 1990 to 1994 when there was one instance of cancer recorded in Grundy County. This was compared to 1995 to 2000 when there were six. If the data are adjusted for population growth and annualized cancer rates, then a 377 percent increase in cancer is observed. However, the cancer rate in Grundy County for youths 15 years old and under is lower than the Statewide average. From 1990 to 2000, the pediatric cancer rate in Grundy County was 8.1 per 100,000 individuals compared to a State rate of 13.7 per 100,000 individuals. As the population of the county increases, the cancer rate would be expected to converge with the Statewide average.

3. Is the pediatric cancer rate higher than the State average in counties where nuclear power plants reside?

   In a study published in 2000 (http://www.idph.state.ill.us/cancer/statistics/htm#O), the IDPH compared child cancer statistics for counties with nuclear reactors to child cancer statistics for similar counties without reactors. It found no statistically significant difference. A followup study published in 2006 confirmed the results of the 2000 study, concluding that pediatric cancer rates near nuclear power plants did not differ from comparison groups in the State and that there is no evidence of an increase in the cancer incidence rate after the startup of nuclear power plants.

4. Was there a 38% increase in cancer among those aged 28 – 44 years old (while the same statistic for all of Illinois decreased by 8%) between 1995 and 1999?

   Death rates due to cancer for individuals aged 28 – 44 years old are not statistically reliable due to the few number of deaths recorded in any one year. For example, from 1995 and 2001, the number of cancer deaths for individuals under the age of 65 in Grundy County was a low of 9 in 1996 and a high of 26 in 1997. The number of cancer deaths in 1999, 2000, and 2001 were 15, 12, and 12, respectively. The Statewide death rate was relatively constant at 64 per 100,000 individuals.

5. Is the leukemia rate 50% higher in men and 100% higher in women in Grundy County compared to the rest of the State?

   Although the leukemia rate in Grundy County appears to be elevated when compared to the rest of the State, the rates are not statistically significant. The number of cases of cancer and the cancer rates represent 5-year totals. Generally, there are very few cases of any specific cancer in a specific year. Hence, the 95-percent confidence intervals for all of the cancer sites are very large. For example, for the years 1994 to 1998, there were 15 cases of leukemia among Grundy County males. The leukemia rate for this period was 20.4 per 100,000 individuals (95-percent confidence interval of 11.3 to 35.1). Compared with the rest of the State, the rate was 17.0 per 100,000 individuals (95-percent confidence interval of 16.5 to 17.5). The Statewide confidence interval is much smaller because there were many more cases of leukemia

(4,158 cases). One reason the Grundy County rates may appear to be high is due to the lack of ethnic diversity in the county; i.e., the leukemia rate for African Americans is considerably less than Caucasians. Illinois is approximately 81 percent Caucasian, and Grundy County is over 99 percent Caucasian.

6. Did the National Academies of Science report that there is no safe level of radiation?

   The National Academies committee that studied the health risks from exposure to low levels of ionizing radiation (BEIR VII) concluded that there is a linear dose-response relationship between exposure to ionizing radiation and the development of radiation-induced solid cancers in humans. The committee judged that it was unlikely that a threshold exists for the induction of cancer but noted that the occurrence of radiation-induced cancer at a low dose will be small. However, the committee did not attempt to equate radiation exposure and safety nor did it offer any judgment or opinion on what constitutes a safe level of radiation exposure. Rather, establishing limits on public exposure to ionizing radiation is the responsibility of Federal agencies like NRC and the U.S. Environmental Protection Agency (EPA).

7. Would the Commission support the establishment of a competitively selected, peer-reviewed grant program to study this (people living near the Illinois reactors may have been exposed to unsafe levels of tritium) and other matters related to the potential for adverse health impacts for those living near nuclear reactors?

   The IDPH has examined pediatric cancer incidence and mortality in the vicinity of nuclear power plants. IDPH issued its most recent report in January 2006. The IDPH evaluated the cancer risk for Illinois children who live near 7 nuclear facilities with 12 nuclear power reactors based on cancer incidence and mortality data from 1990 to 2002. The State epidemiologists concluded that pediatric cancer rates near nuclear power plants did not differ from comparison groups in the State. Furthermore, there was no evidence of an increase in the cancer incidence rate after the startup of nuclear power plants.

   Based on the results of the IDPH's 2000 and 2006 reports on pediatric cancer incidence and mortality near nuclear power plants in Illinois, the Commission would not endorse funding a major epidemiological study of public health among residents living near Illinois nuclear reactors.

3. Report on the facts and circumstances surrounding the leak of tritium by Exelon in Illinois, including the nature and amount of tritium leaked into the environment; when and where the leaks occurred, and when Exelon reported each of them to the NRC.

Note: The reports on the Byron Station and Dresden Station are provided in Item 7 below.

The NRC Region III inspectors reviewed the facts and circumstances of the event at the Braidwood nuclear power plant. The details of the event at the Braidwood plant are provided in the baseline inspection report (Enclosure 2).

The inspectors reviewed the licensee's radiological assessment of unplanned radioactive releases from the circulating water blowdown line that occurred from November 1996 through November 2005, which resulted in the spread of contamination (tritium) in the groundwater, both on site and beyond the site boundary. These releases occurred due to failures of vacuum breaker valves on the circulating water blowdown line. The inspectors reviewed historical records to evaluate the licensee's response to the releases, including radiological surveys, dose assessments, and mitigative actions. The inspectors' evaluation was performed to determine if the licensee adequately implemented the requirements contained in 10 CFR Part 20 and in the licensee's technical specifications. Specifically, the inspectors discussed with licensee staff aspects of the 1996, 1998, and 2000 unplanned releases from vacuum breakers No. 1, No. 3, and No. 2, respectively, as well as other unplanned releases from the vacuum breakers. The inspectors also reviewed the following:

1. radiation protection surveys for affected areas,

2. maintenance work orders for selected vacuum breakers associated with the releases,

3. identification of potential release pathways based upon release location,

4. reports contained in the licensee's corrective action program for these events,

5. parameters and results of licensee's groundwater characterization study,

6. files that contain environmental contamination events,

7. select annual effluent release reports, and

8. select liquid effluent release permits.

Based on the above inspection, the inspectors developed a timeline of events associated with the tritium contamination to understand fully the events and the licensee's response to those events. The timeline can be found in the enclosed Braidwood Nuclear Power Plant inspection report.

4. Report on whether, in light of the BEIR VII report indicating that there is no safe level of radiation and the revelation that people living near the Illinois reactors may have been exposed to unsafe levels of tritium over the course of a decade, would the Commission support the establishment of a competitively selected, peer-reviewed grant program to study this and other matters related to the potential for adverse health impacts for those living near nuclear reactors? If not, why not?

The response to these points and questions can be found in the detailed discussions previously provided for questions 2.6 and 2.7.

5. Please provide a detailed description of all laws, regulations, and orders, applicable to NRC licensees with respect to leaks of tritium into the environment and reporting of such leaks to NRC, and a description of the enforcement remedies and applicable penalties for violations of such regulations.

The NRC regulations are dose-based. Thus, a nuclear power reactor licensee calculates the dose to members of the public from all radioactive gaseous and liquid effluent discharges based on the types and amounts of radioactive material and the local physical site parameters. Tritium is one of many radionuclides in the total volume of radioactive material discharged by a nuclear power reactor on a routine basis.

The information below provides a detailed discussion of the NRC regulations for radioactive gaseous and liquid effluents.

Regulatory Requirements

The principal regulatory basis for requiring effluent and environmental monitoring at nuclear power plants is contained in General Design Criteria 60, 61, and 64 of Appendix A of Title 10 of the *Code of Federal Regulations*, Part 50 (10 CFR Part 50). The criteria require that a licensee control, monitor, perform radiological evaluations of all releases, document, and report all radiological effluents discharged into the environment.

NRC's radiation protection standards contained in 10 CFR Part 20, "Standards for Protection Against Radiation," require that each licensee shall conduct operations so that the total effective dose equivalent to individual members of the public from licensed operations does not exceed 0.1 rem 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 concentration value is $1x10^{-3}$ microcuries per milliliter (mCi/mL) or $1x10^{6}$ picocuries per liter (pCi/L).

Furthermore, NRC requires that power reactor licensees comply with EPA's environmental radiation standards contained in 40 CFR Part 190 (i.e., 25 millirems (mrem) to the whole body, 75 mrem to the thyroid, and 25 mrem to any other organ of any member of the public from the uranium fuel cycle).

NRC also has design objectives in Appendix I to 10 CFR Part 50 to meet the criterion of as low as reasonably achievable (ALARA) for reactor effluents. The design objectives for liquid effluent releases are to maintain off-site annual doses below 3 mrem to the whole body and 10 mrem to any organ. In the technical specifications for power reactors, 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 NRC.

NRC's ALARA criterion is very clear about what is required of power reactors concerning effluent discharges:

> "The licensee shall establish an appropriate surveillance and monitoring program to:
>
> 1. Provide data on quantities of radioactive material released in liquid and gaseous effluents...;
>
> 2. 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 radiation doses to individuals from principal pathways of exposure; and

3. Identify changes in the use of unrestricted areas (e.g., for agricultural purposes) to permit modifications in monitoring programs for evaluating doses to individuals from principal pathways of exposure."

Event Reporting Requirements

NRC has reporting and notification requirements for radiological issues contained in 10 CFR Part 20, "Standards for Protection Against Radiation." These requirements are contained in Subpart M, "Reports," which provides criteria for the radiological issues that licensees are required to report to NRC. In addition, 10 CFR Part 50, Sections 50.72, "Immediate Notification Requirements for Operating Nuclear Power Plants," and 50.73, "Licensee Event Reporting System," provide emergency notification requirements and require licensees to report events that relate to reactor operating conditions. The regulations in 10 CFR 50.75(g) require the licensee to document on-site contamination events. Licensees are required to record spills or other unusual occurrences involving the spread of contamination in and around the facility, equipment, or site and keep the records for the safe and effective decommissioning of the facility. In addition, licensees are required to report unplanned releases in the annual radiological effluent release report.

The licensee is required by 10 CFR Part 20 to notify NRC of releases of radioactive material above prescribed limits and for radiation doses to the public in excess of specified limits. The licensee is also required by its operating license to implement a program for radioactive effluent controls and to monitor the potential impact of radioactive effluents on the environment through a radiological environmental monitoring program (REMP). The REMP requires the licensee to sample various environmental pathways, including waterborne pathways at required intervals, and analyze these pathways for the presence of specified radiological constituents. Reporting levels for radioactivity concentrations in environmental samples are specified in the REMP. The reporting value for tritium in water is 20,000 pCi/L. This value is the EPA Maximum Contaminant Level (MCL) for drinking water, which EPA assumes to yield about 4 mrem/year, if 2 liters of water at the MCL are consumed daily for the entire year.

If the reporting levels specified in the REMP are exceeded, the licensee is required to identify and report the problem and define the corrective actions to NRC. The licensee also is required to report the problem to NRC in the licensee's Annual Radiological Environmental Operating Report. These reports are publicly available.

Enforcement Policy for Violations of Radiological Effluent Regulations

NRC has a defined enforcement policy that classifies violations of its regulations based on the significance of the violation. In assessing the significance of a noncompliance, NRC considers four specific issues: (1) actual safety consequences; (2) potential safety consequences, including the consideration of risk information; (3) potential for impacting NRC's ability to perform its regulatory function; and (4) any willful aspects of the violation. For certain types of violations at commercial nuclear power plants, NRC relies on information from the Reactor Oversight Process's Significance Determination Process (SDP).

NRC uses the SDP to evaluate the significance of inspection findings and to provide a framework for discussing and communicating the inspection findings to licensees and to the public. The NRC's specific SDP for the area of public radiation safety was developed to assess the level of significance of licensee non-compliance with regulatory requirements and licensee programs and procedures related to radiation safety that could potentially impact members of the public. In developing this process, the NRC recognized that a licensee's control of radioactive material is of interest to members of the public even when very low levels of radioactive materials are involved. Consequently, the NRC integrated a deterministic factor into the public radiation safety SDP, which provides for a higher level of significance than would be warranted based solely on the risk from exposure to radioactive material. The level of significance of inspection findings is assigned a color of red, yellow, white, or green, with red being the most significant and green being the least significant.

Violations associated with inspection findings that are not evaluated through the SDP are evaluated and assigned severity levels in accordance with NRC's Enforcement Policy. The NRC categorizes these violations by four levels of severity to show the relative importance or significance. NRC assigns Severity Level I to violations that are the most significant and Severity Level IV violations to the least significant. Severity Level I and II violations are of very significant regulatory concern[1]. In general, Severity Level I and II violations involve potential or actual high consequences to public health and safety. Severity Level III violations also are a cause for significant regulatory concern. Severity Level IV violations are less serious but are of more than a minor concern. NRC does not consider violations at Severity Level IV, which involve noncompliance with NRC requirements, as significant based on risk.

NRC's enforcement program supports the agency's overall safety mission in protecting the public and the environment. NRC uses enforcement as a deterrent to emphasize the importance of compliance with our regulations and to encourage licensee self-identification and prompt, comprehensive correction of any violations.

The primary enforcement sanctions are notices of violation; civil penalties; orders to modify, suspend, or revoke licenses; and orders restricting individuals from participating in licensed activities.

At this time, the inspections conducted by NRC at reactor facilities have not revealed an instance where NRC's public radiation dose limits were exceeded from the release of liquid radioactive effluents.

6. Please provide the NRC's assessment of whether the licensee's actions in this matter may violate any provision of the Atomic Energy Act of 1954 or any rule, order, or requirement prescribed by the NRC thereunder, and if so, a description of what actions the NRC has taken (or is taking) in response to any such violations.

The NRC completed an inspection of the Braidwood Nuclear Power Plant on May 25, 2006. The report is included as Enclosure 2 to this letter. The report contains a preliminary white finding and five apparent violations of NRC requirements. As described in the inspection report,

[1]Regulatory concern pertains to NRC's primary regulatory responsibilities (i.e., safety, safeguards, and the environment).

the licensee is provided the opportunity to respond to these findings and provide additional information, which the NRC will use to reach its final conclusions on the significance of the finding and possible violations of NRC requirements.

7. Please provide a listing of all leaks of tritium by NRC licensees reported to the NRC over the past 5 years, including date (or dates) of the leak, amount of material leaked, licensee responsible, date upon which the NRC was informed of the leak, date upon which the public was informed of the leak, action taken by the licensee in response to the leak, whether tests on groundwater nearby were conducted in order to determine whether safe levels of tritium and/or other radioisotopes (such as radioactive strontium or cesium) have been exceeded (and if so, what the results were), and action taken by the NRC in response to the leak.

In March 2006, the NRC chartered a Liquid Radioactive Release Lessons Learned Task Force (LLTF) to look broadly at recent industry events and our regulatory framework. As part of the LLTF efforts, we are conducting a detailed review and evaluation of specific nuclear plant events that involved inadvertent liquid radioactive material releases. We will have more thorough information and a technical evaluation of the events in the LLTF report. The report will be completed at the end of August 2006. Based on the information known at that time, we will include a summary of each of the plant events and the radioactive materials discharged. Upon approval and issuance of the LLTF report by senior NRC management, we will forward a copy to your office.

The following paragraphs provide a partial review (1996 to present) of inadvertent releases of significant quantities of radioactive liquid to the environment at power reactor sites, including power reactors in decommissioning.

Indian Point Energy Center

In September 2005, during planned excavation adjacent to the Unit 2 spent fuel pool, the licensee for Indian Point discovered small hairline cracks in the concrete wall caused by shrinkage during the concrete curing process that leaked small amounts of spent fuel pool water. Upon further investigation, the licensee determined that groundwater underlying portions of the Indian Point Energy Center (IPEC) site was contaminated with tritium due to possible leakage from the spent fuel pool or other on-site sources. The licensee investigated, determined the apparent source, and characterized groundwater behavior and the extent of contamination. Extensive efforts are underway to install a series of instrumented monitoring wells to characterize groundwater movement, monitor radioactivity, and determine the source(s) of the leakage in order to repair and remediate. On February 27, 2006, a sample showed contamination levels of 30,000 pCi/L at a location close to the Hudson River. At that time, samples from the edge of the river did not show elevated levels of tritium in the water.

On March 21, 2006, the licensee announced that samples taken from an on-site monitoring well located near the Hudson River showed detectable levels of strontium-90; since then, the licensee also has identified elevated levels of nickel-63.

NRC initiated a special inspection on September 20, 2005, to assess the discovery of contaminated water leaking from the spent fuel pool and the subsequent discovery of subsurface groundwater contamination in a monitoring well located in the Indian Point Unit 2

transformer yard. NRC completed its inspection on February 28, 2006. The details of the inspection report can be found in the NRC Agencywide Documents Access and Management System (ADAMS) at No. ML060750842. The report concluded that the leakage resulted in no significant impact on public health and safety. The NRC continues to monitor the licensee's monitoring characterizations of the liquid discharges.

Salem Unit 1

In February 2003, the licensee for Salem Unit 1 identified tritium in on-site groundwater. The licensee identified the cause of the leak as a blockage of the spent fuel pool leak detection system and corrected the problem. In conjunction with the State of New Jersey, the licensee characterized the on-site contamination and established a remediation program. The remediation efforts included the installation of monitoring wells and the pumping of contaminated groundwater for processing. There was no evidence of off-site leakage or migration of contamination. The licensee continues to remediate the on-site contamination and provide for controlled sampling and discharge of the water. NRC performed a special inspection in August 2003 and issued its inspection report in October 2003 (ADAMS No. ML032890212).

Seabrook

During refueling outages beginning in 1999, Seabrook had experienced leakage out of the fuel transfer canal and fuel cask handling area. Following the discovery of the leakage, the licensee conducted inspections of the fuel transfer canal and cask handling areas. Subsequently, the licensee identified a crack in a weld and sealed all affected areas. NRC conducted environmental inspections throughout this period and in December 2005 found the fuel transfer canal repairs had been effective.

To evaluate environmental impact, the licensee installed groundwater monitoring wells in June 2004 and has since monitored the various on-site wells to evaluate the movement of tritium. Tritium levels measured outside the buildings, where the leaks were noted, were found to remain well within the NRC regulatory limits and within the EPA drinking water limits. Currently, the on-site monitoring wells show tritium levels near non-detectable levels. No tritium was detected in other environmental samples, and no other related radionuclides were detected in environmental samples. There was no identified release of tritium outside of plant controlled areas.

Braidwood

Please see the detailed discussion in response to question 3.

Byron

As a result of the issue identified at Braidwood and subsequent NRC inspections, the licensee at Byron has initiated a sampling and analysis program along its circulating water blowdown line to the Rock River. Similar to the system at Braidwood, the Byron blowdown line is about 3.5 miles in length and is equipped with 6 vacuum breaker valves to mitigate any pressure transients within the piping. The piping is on plant property and is also used for planned

radioactive liquid effluent releases. The licensee has inspected all valve pits and identified five of the six valve pits to have some standing water and levels of tritium. The levels ranged from just above detectable to about 80,000 pCi/L. After detecting the tritium, the licensee suspended all radioactive liquid effluent releases. The licensee sampled residential wells and did not detect any radioactive contamination beyond normal background. The NRC conducted independent analyses of the samples and performed some independent sampling, which confirmed the licensee's results.

In February and March of 2006, the licensee sampled locations along the discharge pipe at the Byron facility and installed additional groundwater monitoring wells. Early sampling results indicate some elevated levels of tritium in several valve vaults of its discharge pipe. The licensee also measured low levels of tritium in two groundwater monitoring wells near two of the vacuum breaker valves. However, the licensee has not identified any contamination beyond the plant property line. By April 2006, the licensee had completed all repairs to the vacuum breakers and vaults and recommenced normal liquid effluent releases through the circulating water blowdown line.

Dresden

In August of 2004, the licensee identified an underground leak of its condensate storage tank (CST) piping. The licensee detected levels of tritium in on-site groundwater monitoring wells as high as about 1,700,000 pCi/L. The licensee isolated the leakage and replaced the faulty section of piping in November 2004. The data from the on-site monitoring well confirm that the flow of groundwater is generally away from residential areas and toward the river. In 2004 and 2005, the licensee sampled the private wells of nearby residents. One of the residents' wells had measurable levels of tritium above background (approximately 1,000 pCi/L) and has shown positive results for tritium for a number of years. However, the licensee's other monitoring results and an independent hydrology study do not appear to support that the elevated levels of tritium in that well were from the 2004 CST pipe leakage. The licensee continues to evaluate the tritium in that well, which is included as a normal sample point in its radiological environmental monitoring program. The NRC is following up on the licensee's actions.

In February 2006, the licensee detected elevated levels of tritium in a well located near underground piping, with levels being about 600,000 pCi/L. On-site tritium levels in the two closest wells stabilized at about 20,000 pCi/L - 50,000 pCi/L. The piping supplies water from a storage tank to a plant cooling system. The licensee isolated the leakage and has initiated actions to identify and address the pipe leak. Local tritium contamination levels were confined to a small, interior area of the site. This contamination occurred in the same general area as the underground pipe leak in 2004.

The licensee continues to monitor off-site wells with elevated tritium levels as part of a sample point for the radiological environmental monitoring program.

Callaway

In January 2005, the licensee reported a pipe break, caused by on-site construction activities, that resulted in a monitored effluent discharge to soil and groundwater. As a result, the release was monitored at all times during the discharge; consequently, the radioactive material and

associated dose were accounted for in the permit allowing the release. The licensee suspended all effluent discharges until it fixed the pipe, took soil and water samples, and evaluated any contamination. Followup sampling and analysis of the location around the pipe break was conducted as part of its radiological environmental monitoring program. The 13 samples taken near the pipe break resulted in no detectable tritium levels.

Palo Verde

In 2006, the licensee detected and reported tritium contamination at the Palo Verde site. The licensee dug a 13-foot-deep hole near the Palo Verde Unit 3 tunnel where the spray pond piping penetrates the vault in response to water found inside the pipe tunnel. The licensee took three samples of water and tested for tritium. The test found tritium in all three samples: 75,000 pCi/L, 30,000 pCi/L, and 70,000 pCi/L. The licensee has identified three potential sources for the tritium, including a holdup tank, nearby system piping, and plant stack discharges that were washed into the ground during rainfall. NRC's inspectors are evaluating the licensee's efforts in tracing the origin of the leak and quantifying the amounts of tritium and its movement in groundwater. Future plans include removal of tritiated water, site drainage improvements to prevent infiltration, procedural refinements, and well monitoring.

Watts Bar

In August 2002, the licensee detected low levels of tritium (less than 1,000 pCi/L) in one on-site well. The well is included in the routine radiological environmental monitoring program. Additional sampling conducted in 2003 revealed the presence of tritium in three other wells at levels up to 20,000 pCi/L. Historically, concentrations of tritium have averaged about 5,000 pCi/L until January 2005, when there was a sudden increase to about 500,000 pCi/L. The licensee identified several potential sources of leakage and tritium, including the fuel transfer canal and tube, refueling water storage tank, spent fuel pool, spent fuel cask loading pit, and liquid effluent lines. In addition, the licensee also inspected numerous liquid process system tanks for evidence of leakage. The licensee has taken actions to reduce or eliminate the identified sources of tritium leakage into groundwater. The licensee continues to monitor and assess the extent of groundwater contamination and the levels and movement of tritium in groundwater. NRC inspectors will review and evaluate these issues during the next scheduled NRC inspection.

Perry

On March 28, 2006, the licensee collected and analyzed a quarterly sample from a manhole in the under drain system that surrounds the perimeter of the plant system for tritium and gamma-producing isotopes. The licensee measured about 60,000 pCi/L of tritium with no detectable gamma-producing isotopes. Subsequent measurements at other points in the underdrain system showed lower levels of tritium. Off-site environmental monitoring has shown no measurable tritium.

On April 5, 2006, the licensee reported the detection of 1700 pCi/L of tritium in an underdrain system that surrounds the perimeter of the plant. The underdrain system is designed to collect water from the area under and around the plant foundation and is well within the owner-controlled area. The system discharges to the Emergency Service Water Intake on Lake Erie.

The licensee attributed the tritium to leakage from a flange in the feedwater system. The tritium-contaminated water migrated into the underdrain system, then to the Emergency Service Water Pumphouse, where it was monitored and discharged. The licensee has since repaired the leaking flange, and the tritium levels have demonstrated a corresponding decline.

Haddam Neck

In October 2005, the licensee identified an area of low level soil contamination near an exterior spent fuel pool wall. The Haddam Neck nuclear plant ceased operations 10 years ago and is being dismantled. The licensee is evaluating this contamination to determine if it may be from a previous spent fuel pool leak or a spill which may have occurred during plant operations. An NRC inspection in November 2005 did not identify evidence of an active or previous leak. No off-site public dose impacts have been identified.

8. When leaks such as those that occurred in Illinois take place, is the licensee required to test groundwater nearby to determine whether safer levels of tritium have been exceeded? What about testing to determine whether other radioisotopes were also leaked at levels in excess of safe standards? If not, would you be supportive of legislation mandating such testing as well as the conveyance of test results to the Commission and members of the public?

A licensee must comply with many NRC requirements regarding the release of liquid radioactive materials either through normal discharge points or as a result of an inadvertent leak. A licensee is required to perform detailed radiological surveys of the areas impacted by any and all reactor-produced radioactive material. The licensee must survey all reactor-produced radionuclides expected to have been released, in addition to tritium. The appropriate surveys performed by the licensee are based on the specific migration pathways for the material and the radionuclide composition. For liquid releases onto the ground, the licensee must evaluate the potential for the material to migrate into the groundwater. Thus, NRC regulations require the licensee to survey the groundwater in and around the impacted area. The surveys are required to evaluate the radiological hazard associated with the release and to demonstrate compliance with the public radiation safety limit. NRC inspects the results of the licensee's surveys for adequacy and regulatory compliance with radiation safety limits and makes this information publicly available in ADAMS.