February 23, 2006

MEMORANDUM TO: Office Directors and Regional Administrators
(See attached list)

FROM: Luis A. Reyes ***/RA/***
Executive Director for Operations

SUBJECT: LESSONS LEARNED TASK FORCE TO ADDRESS TRITIUM RELEASES

Recent incidents at Braidwood, Indian Point, Byron, and Dresden have highlighted a concern with tritium contamination of groundwater as a result of unplanned releases due to equipment degradation. For example, unintended releases resulted in migration of tritium through groundwater causing elevated levels of tritium in groundwater in unrestricted, public areas. Although the measured levels of tritium are above background levels, they remain well below NRC's regulations for release and EPA's standards for drinking water. However, the public and other stakeholders have expressed concerns. In response to these concerns, I believe it is necessary to do a review across the regions to determine whether this is a generic concern for NRC licensees and to identify actions to be taken to address the concern.

I am directing that a Lessons Learned Task Force be formed to perform these functions. The objective will be to conduct a review of events and releases at NRC licensed sites across all four regions to determine the extent of the concern, the actions taken, and make recommendations for improvement to NRC processes and regulations. Within the next two weeks NRR is to: 1) assign a team leader to lead the inter-office task force; 2) work with NMSS, RES and the regions to identify the remaining team members; and 3) draft a Charter to define the objective, scope, expected products, schedule, staffing, and senior management interface. It is desired that the team leader be at minimum a Deputy Division Director. The team leader should work with Jennifer Dixon-Herrity (415-1733) of my staff in developing the Charter. The scope of the task effort should include, but not be limited to, the following: 1) the extent of the concern across the regions; 2) the adequacy of communications of these issues; 3) decommissioning concerns that may need to be addressed; and 4) the adequacy of the current NRC regulations (10 CFR Part 20 limits) and programs. Attached for information is: 1) a background document developed for the issue; and 2) a list of inadvertent liquid or solid radioactive material releases offsite, that were more than minor, since 1985.

The task force will periodically brief the DEDR and other senior managers regarding the progress of the task force. The task force will provide its observations, conclusions, and recommendations in the form of a written report consistent with the guidance to be provided in the charter. The team's recommendations will be considered for entry into the agency's new corrective action program for significant lessons learned.

Attachments: As stated.

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**ML060520328**

| OFFICE | OEDO:TRPS | OEDO:TRPS | OEDO:AO | OEDO:DEDR | EDO |
|---|---|---|---|---|---|
| NAME | Jennifer D-Herrity/ssb | Thomas Bergman | William Dean | William Kane | Luis Reyes |
| DATE | 02/21/2006 | 02/ /2006 | 02/22/2006 | 02/23/2006 | 02/23/2006 |

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MEMORANDUM TO THOSE ON THE ATTACHED LIST DATED:

SUBJECT: LESSONS LEARNED TASK FORCE TO ADDRESS TRITIUM RELEASES

| | E-Mail Mail Stops |
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**Background Developed for Tritium Releases from Nuclear Power Plants into the Public Domain and Listing of Plant Events in the Last Year**

Question: Have there been other Tritium releases from nuclear power plants into the public domain ?

Response: We conducted a quick poll of the four NRC Regions and Headquarters staff and data files for any historical knowledge on abnormal tritium release and the answer is no. There have been no unplanned, unmonitored, abnormal discharges of tritium into the public domain via the groundwater pathway. However, there are routine, planned, controlled, and monitored discharges of radioactive gaseous and liquid discharges, which included tritium, into the public domain from all operating nuclear plants (i.e., power and research non-power reactors). These routine discharges are in accordance with NRC regulations. The NRC routinely inspects licensees radioactive effluent release and environmental monitoring programs for compliance with regulatory requirements and safety limits.

On-site ground contamination recent events

While there have been no other abnormal events in which tritium reached the public domain, there have been several events at nuclear power reactors in which there have been spills, leaks, or other unusual occurrences where tritium has been discharged onto the licensee's plant site, which did not migrate into the public domain.

Region I

Indian Point: Investigation is in progress. To date, there is no evidence that tritium contaminated groundwater has been released to the public domain. To date, samples of groundwater from off-site locations, including routine required samples, have not identified tritium above background levels.

Yankee Rowe (Decommissioned): The NRC is considering a request dated June 6, 2005, by the Yankee Atomic Electric Company to approve the continued use of concrete blocks containing tritium as a retaining wall at an off-site location in Vermont. The request for approval is submitted pursuant to Section 20.2002 of Title 10 of the Code of Federal Regulations, "Method of Obtaining Approval of Proposed Disposal Procedures." The licensee's proposed disposal is to demonstrate the material is exempt from Atomic Energy Act and NRC licensing requirements and acceptable for continued use as a retaining wall at an off-site location.

Haddam Neck: PNO-I-05-028, describes tritium discovered in the on-site groundwater, but not off-site.

Salem: While the issue at Salem was in 2003, the licensee identified tritium adjacent to the Salem Unit 1 spent fuel pool within the protected area. This was the subject of an NRC special inspection in August 2003 (Reference ML032890212). To date, there is no evidence that tritium contaminated groundwater has been released into the public domain; and, remedial actions are in progress. To remediate the condition, the licensee installed a number of monitoring wells and is pumping out contaminated ground water for processing as radioactive waste. Region 1

is monitoring the licensee's activities. In addition, the State of New Jersey has been involved in sampling and monitoring of site wells.

Region III

Braidwood: On November 30, 2005, the licensee informed the NRC Resident Inspectors of higher than expected tritium levels (~58,000 picoCuries per liter) measured in on-site monitoring wells at the norther edge of the owner controlled area. The licensee attributed the higher levels of tritium to historical vacuum breaker valve leakage in the circulating water blowdown line to the Kankakee River that occurred in 1998 and 2000. The licensee uses the blowdown line to perform liquid effluent releases to the river.

As of December 4, 2005, the licensee has detected measurable levels of tritium in offsite groundwater. Although nearby residential wells have not shown any tritium above normal background, the licensee detected elevated levels of tritium (as high as approximately 33,700 picoCuries per liter) in monitoring wells in a vacant development immediately offsite. The licensee continues to monitor and to develop plans for remediation.

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 onsite groundwater monitoring wells as high as 1,700,000 picoCuries per liter. The licensee isolated the leakage and replaced the faulty section of piping (November 2004). Onsite monitoring well data confirm that the flow of groundwater is generally away from any residential areas and towards 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 900 - 950 picoCuries per liter) 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 a normal sample point for its radiological environmental monitoring program.

Related Historical Data

Point Beach: Several years ago, the licensee measured tritium onsite in an old retention pond. Since that time, the pond has been closed, and the land has been encased in concrete. However, no offsite contamination appears to have occurred.

Prairie Island: In the early 1990s, the licensee measured tritium in onsite monitoring wells from the leakage of the effluent discharge pipe. The licensee monitored the groundwater for a number of years, as the underground tritium plume migrated to the river. However, no offsite groundwater contamination appears to have occurred.

Davis Besse: Approximately 15 - 18 years ago, the licensee identified leakage from the liquid effluent discharge pipe that transports effluents to the lake. However, no offsite contamination appears to have occurred.

Watts Bar: The licensee identified on-site leakage from a radioactive waste pipe which discharges transports the liquid effluent. However, no offsite contamination has occurred.

Background Information on NRC Effluent and Environmental Monitoring Requirements

This section identifies the NRC regulatory requirements for radiological effluent and environmental monitoring programs and radiation dose limits for protection against radiation.

Regulatory Requirements

Radiological environmental monitoring and effluent monitoring at nuclear power plants is required by U.S. Nuclear Regulatory Commission regulations. The monitoring of radioactive effluents and the environment around the nuclear power plant is important both for normal operations, as well as in the event of an accident. During normal operations, environmental monitoring verifies the effectiveness of in-plant measures for controlling the release of radioactive materials, and makes sure that the levels of radioactive materials in the environment do not exceed those originally anticipated prior to licensing the plant. For accidents, it allows an additional means for estimating doses to members of the general public.

The principal regulatory basis for requiring environmental monitoring and effluent monitoring at nuclear power plants is contained in General Design Criteria 64 of Appendix A of Title 10 of the Code of Federal Regulations Part 50 (i.e., 10 CFR Part 50), and Section IV.B of Appendix I of 10 CFR Part 50. Section IV.B states that:

> "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."

Results from the environmental and effluent monitoring programs are reviewed by the NRC during routine inspections, and if the data indicate that the relationship between the quantities of effluents and the calculated doses to individuals is significantly different than that assumed in the licensing calculations, then the NRC may modify the allowable quantities in the Technical Specifications for the nuclear power plant.

Prior to licensing a nuclear power plant, the NRC staff review the applicant's proposed radiological environmental program. The applicant conducts a preoperational program at least two years prior to initial criticality of the reactor. The preoperational program documents the background levels of direct radiation and concentrations of radionuclides that exist in the environment. It also provides an opportunity for the licensee to train personnel, and to evaluate procedures, equipment, and techniques.

A licensee's preoperational environmental monitoring program is reviewed by NRC staff in regard to the criteria contained in the NRC's Radiological Assessment Branch Technical Position, Revision 1, November 1979, "An Acceptable Radiological Environmental Monitoring Program." The Branch Technical Position (BTP) contains an example of an acceptable minimum radiological monitoring program. Highlights of the BTP include: monitoring of air at the offsite locations where the highest concentrations of radionuclides are expected; placement of dosimeters in two concentric rings around the plant; water samples (i.e., surface, ground, and drinking) upstream and downstream; milk samples at locations where the highest doses are expected; and various food samples. Lower limits of detection for the various types of samples and nuclides are specified.

The operational radiological environmental monitoring program is essentially a continuation of the preoperational program. The minimum requirements of the program are specified in the Radiological Effluent Technical Specifications (RETS) that are required pursuant to 10 CFR 50.36a. In addition, more detailed information about the program is contained in the licensee's Offsite Dose Calculational Manual, which is referenced in the plant's RETS. The RETS also require that the licensee submit: (1) an annual radiological environmental monitoring report which is designed to assess the impact of radiological effluent releases into the environment; and (2) a Special Report within 30 days of discovery of the event if predetermined levels of

radioactivity are exceeded. The NRC also requires that the licensee participate in an Interlaboratory Comparison Program to ensure the accuracy and precision of the licensee's data.

The results of licensee's radiological environmental monitoring and effluent release programs are required to be reported annually to the NRC, and are available to the public.

Radiation Dose Limits

10 CFR Part 20, STANDARDS FOR PROTECTION AGAINST RADIATION

The regulations contained in 10 CFR Part 20, effective January 1, 1994, establish standards for protection against ionizing radiation resulting from activities conducted under licenses issued by the NRC. The purpose is to control the receipt, possession, use, transfer, and disposal of licensed material to ensure that the standards of radiation protection are not exceeded.

10 CFR 20.1301, Dose limits for individual members of the public. This regulation requires licensees to conduct operation of their facility so that the total effective dose equivalent to a member of the public does not exceed 0.1 rem (100 mrems) in a year. It should be noted that prior to January 1, 1994, 10 CFR Part 20 had an annual dose limit of 500 mrems to a member of the public.

10 CFR 20.1301 (e), imposes an additional requirement on nuclear power reactors to comply with the Environmental Protection Agency' s radiation protection standard in 40 CFR Part 190. This standard limits the annual dose to a member of the public to less than or equal to 25 mrems to the total body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems.

For the release of radioactive effluents, the NRC imposes specific requirements for airborne and waterborne effluent releases that are contained in 10 CFR 50.36a and detailed in Appendix I to 10 CFR Part 50 (hereafter called Appendix I). These requirements are structured to maintain the dose to members of the public from all radioactive effluent releases to levels that are as low as reasonably achievable (ALARA). The controls imposed on licensees are not on the quantity of radioactive material released or the concentration or radioactivity in the effluents, but are on the doses to members of the public. The licensee's RETS contain the dose values (obtained from Appendix I) to the maximally exposed member of the public living near a nuclear power plant. In essence, they are as follows:

1. Gaseous effluents shall not produce doses to offsite air of more than 10 mrads from gamma radiation and 20 mrads from beta radiation in a year.

1a. Gaseous effluents shall not produce doses to members of the public of more than 5 mrems to the total body and 15 mrems to the skin in a year.

2. Radioiodine, tritium, and particulate radiation in gaseous effluents shall not produce doses to a member of the public of more than 15 mrems to the thyroid (or other organ) in a year.

3. Liquid effluents shall not produce doses to any member of the public of more than 3 mrems to the total body or 10 mrems to any organ in a year.

4. The licensee shall take other measures to reduce offsite doses that cost less than $1000 per person-rem saved.

In addition to the annual doses listed above, the RETS impose controls on the maximum dose to a member of the public in a calendar quarter. They are as follows:

1. Gaseous effluents, during any calendar quarter, shall be less than or equal to 5 mrads for gamma radiation and less than or equal to 10 mrads for beta radiation.

2. Radioiodine, tritium, and particulate radiation in gaseous effluents, during any calendar quarter, shall be less than or equal to 7.5 mrems to any organ.

3. Liquid effluents; during any calendar quarter, the dose shall be limited to less than or equal to 1.5 mrems to the total body and to less than or equal to 5 mrems to any organ.

In addition to the controls imposed by the RETS on the maximum dose to members of the public from radioactive effluents, there are controls on the rate at which radioactive material can be released. These controls, imposed on liquid and gaseous effluents, represent a defense in depth approach to further ensure that radioactive effluents and the resulting doses are ALARA. The release rate controls are as follows:

1. Gaseous effluent releases of noble gases shall be less than or equal to 500 mrem/year (0.06 mrem/hour) to the total body and less than or equal to 3000 mrem/year (0.3 mrem/hour) to the skin.

2. Radioiodine, tritium, and particulate radiation in gaseous effluents shall be less than or equal to 1500 mrem/year (0.2 mrem/hour) to any organ.

3. Liquid effluents shall be limited to the concentrations specified in 10 CFR Part 20, Appendix B.

RADIOACTIVE EFFLUENT AND ENVIRONMENTAL MONITORING REQUIREMENTS

10 CFR 50.34a, Design objectives for equipment to control releases of radioactive material in effluents - nuclear power reactors.

10 CFR 50.36a, Technical specifications on effluents from nuclear power reactors.

10 CFR Part 20, Standards for Protection Against Radiation.

10 CFR 50.72, Immediate notification requirements for operating nuclear power reactors.

10 CFR 50.73, Licensee event report system.

10 CFR Part 50, Appendix I, Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion "As Low As Is Reasonably Achievable" for Radioactive Material in Light-Water-Cooked Nuclear Power Reactor Effluents. (40 FR 19437 as an effective rule on May 5, 1975)

Regulatory Guide 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 (Rev. 1, 10/75).

Regulatory Guide 4.1, Programs for Monitoring Radioactivity in the Environs of Nuclear Power Plants. (1/73)

Regulatory Guide 4.2, Preparation of Environmental Reports for Nuclear Power Stations. (Rev. 2, 7/76)

Regulatory Guide 4.8, Environmental Technical Specifications for Nuclear Power Plants

(12/75) and Branch Technical Position (Rev. 1, 11/79; specific to environmental monitoring program).

Regulatory Guide 4.15, Quality Assurance for Radiological Monitoring Program (Normal Operation) - Effluent Streams and the Environment.

Regulatory Guide 1.21, Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants. (Rev. 1, 6/74)

Regulatory Guide 1.143, Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants. (Rev. 1, 10/79)

NUREG-0472, Radiological Effluent Technical Specifications for PWRs. (2/80)

NUREG-0473, Radiological Effluent Technical Specifications for BWRs. (7/79)

10 CFR Part 50, Appendix A; Design Criteria 60, Control of Releases of Radioactive Materials to the Environment.

10 CFR Part 50, Appendix A; Design Criteria 64, Monitoring Radioactivity Releases.

40 CFR Part 190, Environmental Radiation Protection Standards for Nuclear Power Operations. (1/77)

NRC INSPECTION PROCEDURE

NRC Inspection Procedure 71122 - Public Radiation Safety

**Inadvertent Liquid or Solid Radioactive Material Releases Offsite Since 1985**

**Request:** Identify inadvertent liquid or solid radioactive material releases offsite, that were more than minor in nature (ie, very small quantities that were clearly not a threat to public health and safety) since 1985.

**Response:** A quick poll of the four NRC Regions and Headquarters staff was performed for any historical knowledge on inadvertent liquid or solid radioactive releases offsite, that were more than minor in nature. Many of these events were included based on the Region having issued a violation against the licensee. Some events were included based on significant public interest in the event.

**Region I:**

**Fitzpatrick:** March 1991, Release from an auxiliary boiler to the atmosphere was washed out by rain, subsequently low level activity was collected in the onsite storm drains which discharge to Lake Ontario.

**Haddam Neck:** Some contaminated soils from 1970s and 80s were used as fill for various on-site and off-site locations. An off-site material recovery program recovered the material from the off-site lacations in the 1998 to 2000 time frame.

Radioactive liquid from a spent fuel drain pipe went to a storm drain system and then to the river in 1989; not monitored; subsequently determined to be less than Technical Specification limits.

Release of contaminated liquid to an onsite sanitary sewage system leach field occurred in 1989, and the resultant contaminated sewage sludge was released to a municipal landfill.

**Limerick:** Five bags containing radioactive material were inadvertently transported to the Pottstown Landfill on March 11, 2002; the licensee subsequently retrieved the bags; a green finding was identified.

**Millstone:** Dredgings with licensed activity greater than the survey instrument's sensitivity were sent to an offsite landfill.

**Oyster Creek:** Radioactive condensate liquid system, cross-connected to cooling water system, resulted in the discharge of 130,000 gallons of radioactive liquid to the discharge canal and then to Barnegat Bay in September 1996 (total release of 7.5 Curies, mostly tritium).

Contaminated sewage sludge spread on a farmer's field and later remediated.

**Peach Bottom:** Contaminated sewage was transported offsite and not remediated.

**Pilgrim:** Contaminated soil was washed offsite by rain in late 1980s.

**Vermont Yankee:** Condensate storage tank overflowed in mid 1980s with overflow reaching the river.

ATTACHMENT 2

**Yankee Rowe:** Concrete reactor shield blocks were released offsite in late 1990s; they are now part of retaining walls on private property. Alternate disposal application pending.

An unmonitored but documented continuous liquid release (H-3) from a leak from an ion exchange pit went to east and west storm drain systems and then to the river.

**Millstone:** Contaminated tools were found in an offsite warehouse.

**Region II:**

**St. Lucie:** 1980s release of contaminated sewage sludge into a public landfill.

**Turkey Point:** 1980s release of contaminated seaweed into a public landfill.

**Region III:**

**Braidwood:** On November 30, 2005, the licensee informed the NRC resident inspectors of higher than expected tritium levels (~58,000 picoCuries per liter) measured in onsite monitoring wells at the northern edge of the owner controlled area. The licensee attributed the higher levels of tritium to historical vacuum breaker valve leakage in the circulating water blowdown line to the Kankakee River that occurred in 1998 and 2000. The licensee uses the blowdown line to perform liquid effluent releases to the river.

**Dresden:** In August 2004, the licensee identified an underground leak of its condensate storage tank piping. The licensee detected levels of tritium in onsite groundwater monitoring wells as high as 1,7,00,000 picoCuries per liter. The licensee isolated leakage and replaced the faulty section of piping in November 2004. Onsite monitoring well data confirm that the flow of groundwater is generally away from any residential areas and towards 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 900-950 picoCuries per liter) 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 a normal sample point for its radiological environmental monitoring program.

In 1993 or 1994, the licensee identified that the Unit 1 Service water line had frozen. As a result, contaminate liquid may have been released to the environment.

**Prairie Island:** In the early 1990s, the licensee measured tritium in onsite monitoring wells from the leakage of the effluent discharge pipe. The licensee monitored the groundwater for a number of years, as the underground tritium plume migrated to the river. Although the licensee is monitoring some tritium in an offsite well, we arenot certain if this is related to the incident.

**Quad Cities:** Over the past several years, the licensee has had a few incidents involving the inadvertent removal of material from the site. The material has consisted of contaminated tools and dirt.

**Davis Besse:** 2002, the licensee inadvertently released individuals who were contaminated with radioactive "hot" particles. The NRC initiated a special inspection to review the incident. The particles were found in public areas (hotels and residences), and a violation (green finding) was issued.

**Dresden:** In the late 1980's or early 1990s, the licensee performed a comprehensive survey of items outside of its radiologically restricted area and identified a few hundred contaminated

pieces of tools and equipment. Some of that material may have been found outside of the owner controlled area.

Approximately 10 to 15 years ago, some contaminated soil may have been inadvertently released from the site. We believe the material was reclaimed and ultimately shipped for radioactive burial.

**Region IV:**

No event reported.

**Fuel Cycle Facilities:** A quick poll of the NMSS and Region II staff was performed for any historical knowledge on inadvertent radioactive releases offsite, that were more than minor in nature. These events are gaseous, liquid or solid releases vs. the reactor events which are liquid or solid releases. In addition, consequences from these events resulted predominantly from chemical effects vs. radiological effects.

**Sequoyah Fuels:** 1986 UF6 release resulting in injuries and a fatality. 1991 UF6 release resulting in injuries.

**Honywell:** CaF2 shipment that was taken to a farm and dumped such that the licensee had to have it cleaned up (residual uranium from treating fluoride waste); 2003 UF6 release resulting in injuries.

**Portsmouth:** 2000 fire and UF6 release.

**Nuclear Fuels Services:** Late 1980s/early 1990s spill on railroad property of uranium solutions. early 1990s radiological release to sanitary sewer, from hand-washing, laundry, etc.

**Framatome Richland (then Siemens?):** Lagoon leaks sometime in 1990s leading to uranium plume in groundwater.