Submitted GN 8-15-06 for response.

July 29, 2006

Thought you might find the enclosed American Nuclear Society piece about the Braidwood tritium leakage of interest. The leakage is described as "significant (though small)," whatever that means. (Nuclear News, July 2006, pp 21-22)

It is my understanding that water containing at least some tritium and other isotopes --- totaling a concentration of gamma-emitters below the discharge monitor's Alarm/Trip SETPOINT --- could well be released almost daily. That is, in levels "allowed by the Braidwood license." (Bullet #11) Tritium is also released (purged or vented) as a gas to the atmosphere from vents on various buildings, such as the Reactor Containment, Auxiliary, and Turbine buildings.

--- In addition, noble gases (like xenon and krypton) are also vented to the atmosphere, ***and*** **dissolved and entrained noble gases** are released off-site via the same liquid-waste discharge pathways as are the tritium liquid releases. (When a krypton atom releases its beta particle, it becomes rubidium, and then, after another decay, becomes strontium. Xenon decays into cesium. Both cesium and strontium are notoriously radiotoxic, as we learned during the atmospheric atom bomb tests. Sr-90 has a half-life of 29 years. Cs-135 has a half-life of 2.3 million years.)

--- When solvents (such as EDTA) are used to dissolve radioactive corrosion products ("crud") and activation products that have accumulated on piping surfaces and on fuel rod cladding, etc., various **dissolved activation and corrosion materials** can end up being released to the environment via the discharge water. The dissolved isotopes are apt to be present in both the planned batch releases and in the continuous-flow releases to the Kankakee River (or to whichever river, lake or ocean is both the source of a nuclear power plant's cooling water and the recipient of its discharge water.)

Some comments and questions:

1. Not just tritium is present in the plant's liquid-waste leaks and spills. No economically feasible technology exists to filter the tritium from the discharge (blowdown) water, so why and how could there be discharge water containing only tritium? That is, **what is the source of the discharge water that allegedly contains tritium alone, with no other fission, corrosion, or activation isotopes present?**

2. What permissible concentration level of dissolved and entrained noble gases is allowed in the liquid effluents (in microcuries per milliliter, or picocuries per liter)? What is the lower limit of detection of each of the monitors that measure noble gases in liquid waste releases?

(A commonly used definition of "lower limit of detection" [LLD] = the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.)

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3. How accurately can dissolved corrosion and activation products be detected in samples of liquid effluents? For example, for which, if any, of the following corrosion isotopes are radioassays specifically performed: cobalt-58 and -60; nickel-55, -57, and -63; manganese-54; and iron-59?

4. Re Bullet #3 on p. 21: Assuming the NRC were to require a licensee to notify his state agency(ies) 28 days in advance of discharging tritiated water, what would be the estimated frequency of such notifications? Could the licensee perhaps have to notify the state on a daily basis?

5. Bullet #6: As noted in the NIRS fact sheet, entitled "Are Federal Permissible Standards for Tritium Too Permissive?", * the NCRP and IAEA estimate the average amount of tritium found in natural waters to be from **3 to 24 picocuries per liter**. What level of tritium has the NRC decreed to be the amount that "could be considered [to be] naturally occurring"?

6. Bullet #7: regarding the detection of tritium near (or below?) the Braidwood Turbine Building ---

(a) At what concentration level of tritium is the Turbine Building Drain Monitor set to detect? That is, what is the setpoint level of tritium that would trigger the alarm and initiate the automatic termination of releases to the environment?

(b) What is the monitor's Lower Limit of Detection for tritium?

(c) Is the Steam Generator Blowdown Monitor located in the Turbine Building?

(d) What is the Alarm/Trip Setpoint for tritium of the Steam Generator Blowdown Monitor? What is its Lower Limit of Detection?

7. Bullet #9, p. 22: Has Exelon submitted its proposed plan for diverting liquid wastes away from subsurface and surface water --- that is, the liquid wastes that contain tritium levels in excess of the EPA's permissible drinking water level (20,000 picocuries per liter)? Is the Exelon plan designed to cover only planned, batch releases of tritiated liquid wastes --- or of continuous-flow releases, as well?

8. Bullet #11: Re releases to the environment that are "not allowed by the Braidwood license":

(a) Does the NRC allow a licensee's effluent water to contain a concentration of **one million picocuries per liter** of tritium --- that is, 1E-3 microcuries per milliliter, as per the Code of Federal Regulations, Title 10, Part 20, Appendix B, Table 2, Column 2 ? According to the introduction to App. B, one million pCi/L would produce a total effective dose equivalent of 50 millirem, if ingested continuously over the course of a year

(b) Or can the effluent contain **two million pCi/L** of tritium, which would yield the NRC's permissible annual dose of 100 millirem, as per 10 CFR 20 1301(a)(1) ?

* http://www.nirs.org/factsheets/tritiumnaturalbackground.pdf

the convenience of renewing both Catawba and its two-unit McGuire plant in a single application.

■ The NRC has proposed interim staff guidance on license renewal applications for boiling water reactors with Mark I containments and steel drywell shells. The guidance was published in the *Federal Register* on May 9 and comments from the public were accepted through June 8. The guidance calls for applicants to develop aging management programs for potential corrosion in inaccessible areas of the drywell. The issue of whether such corrosion can be controlled or managed has been admitted as a contention in the renewal proceeding for the Oyster Creek BWR and a hearing will be held on the matter.

BRAIDWOOD

Cleanup pact agreed; "white" finding proposed

State and county officials are continuing to pursue legal action against Exelon Generation Company in connection with the leakage of tritiated water at the Braidwood plant in Illinois, but on May 24 the two sides agreed on immediate actions to be taken by Exelon to prevent uncontrolled and unnoticed leakage on the plant site. Exelon referred to this development only as an "agreement" while the Illinois Attorney General's Office called it a "preliminary injunction" by the Will County Circuit Court. The next day, the Nuclear Regulatory Commission notified Exelon that the agency's inspection report on the tritium leakage first noticed last November designates the incident as a preliminary "white" finding, indicating low to moderate safety significance.

Braidwood's license permits the occasional use of a blowdown line to remove water that bears small amounts of tritium from the reactors. Normally this water is discharged through a five-mile pipe that empties into the Kankakee River, so that when the discharge occurs there is no health or safety hazard posed by the tritiated water. Last November, however, it was discovered that leakage of blowdown line water through valves elsewhere on the plant site had spilled tritiated water with significant (though small) radioactivity, some of which was later found to have entered the groundwater and was detected in a drinking-water well off site (*NN*, Mar. 2006, p. 12). Plant personnel had been aware of some leakage in valve vaults but were not aware that the volume was as large as it was. Uncontrolled tritium releases were found to have taken place on occasion dating back to 1996, and further study by Exelon found other instances of uncontrolled tritium releases at two other Illinois plants, Byron and Dresden. None of the releases detected off site have exceeded the Environmental Protection Agency limit for drinking water.

The Illinois attorney general and the Will County state's attorney sued Exelon in March (*NN*, Apr. 2006, p. 17) seeking $50 000 for each alleged violation of state pollution laws and $10 000 for each day the alleged violations continued. The actions announced on May 24 grew out of discussions related to the lawsuit. Exelon has committed to do the following:

1. ■ Lower the water level in a pond so that tritiated groundwater will drain into the pond from which it will be piped to a blowdown line and then to the Kankakee River.
2. ■ Install and maintain leak-proof barriers at the base of each vacuum breaker valve pit and monitoring equipment so that any leakage during a discharge of tritiated water will alert operators to stop the flow to the blowdown line.
3. ■ Give state agencies 28 days' notice before discharging tritiated water to the blowdown line.
4. ■ Establish weekly visual surveillance and monthly groundwater sampling along the length of the discharge line from the plant to the river.
5. ■ Sample water from 280 residential wells in and around Godley, Ill., until the end of June and provide residents with test results within 10 days of each test.
6. ■ Provide bottled water to about 420 homes in and around Godley until future testing of the wells shows no tritium beyond what could be considered naturally occurring and give two weeks' notice prior to discontinuing bottled water supplies.
7. ■ By June 30 provide the state with a report of an investigation of tritium in groundwater near vacuum breaker valves and the turbine building.

Continued

Power Briefs

THE NRC WILL SET UP A CONSTRUCTION INSPECTION CENTER at its Region II Office in Atlanta. The Nuclear Regulatory Commission announced on May 17 that the Construction Inspection Program (CIP) will be responsible for day-to-day and special inspections of new power reactor construction anywhere in the United States. Its establishment in Atlanta puts the CIP office in fairly close proximity to nearly all of the announced projects for new power reactors. The NRC is to review the program annually both to address developments in new reactor projects and to ensure that Region II's mission to oversee operating reactors in the Southeast is not adversely affected.

SEABROOK HAS BEEN GRANTED A 1.7 PERCENT POWER UPRATE, whereby more accurate measurement of feedwater flow would allow the reactor to operate at a peak output of about 1240 MWe, up from the current 1220-MWe level. FPL Energy Seabrook intends to begin operation at the higher power level after a refueling outage scheduled for autumn. The pressurized water reactor near Seabrook, N.H., had been granted a power uprate of 5.2 percent in February 2005, which raised its output from 1148 MWe to its present level.

TXU SAYS NEW REACTORS CURRENTLY WOULD BE TOO COSTLY to build and too difficult to site in Texas, according to a June 8 press release. In the course of announcing plans for 11 new coal-fired plants in the company's service area (mainly north and central Texas), TXU Electric—the owner and operator of the two Comanche Peak power reactors—stated, "Technological and regulatory breakthroughs will be required to make nuclear power a real alternative. TXU will continue to investigate this option by exploring the expansion of its Comanche Peak nuclear power facility." TXU has been mentioned recently as a potential customer for new reactors, but the statement appears to indicate that any such potential would not be realized in the near term.

SCE WOULD ACQUIRE ANAHEIM'S SHARE OF SAN ONOFRE if the necessary license amendment for the transaction is approved by the Nuclear Regulatory Commission. The NRC announced in the June 8 *Federal Register* that it is considering the issuance of an order transferring the city of Anaheim's share of San Onofre, currently 3.16 percent, to the plant's principal owner, Southern California Edison Company (SCE). Anaheim would continue to retain its ownership of the plant's spent fuel. The ownership of shares in the plant has shifted over time based on the willingness of minority owners to pay for additional expenses at the plant, such as steam generator replacement. The deadline for public comments on the proposed transfer was June 28.

8. ■ By July 1, submit to the Illinois Environmental Protection Agency (IEPA) a plan for preventing the migration off site of water with tritium activity greater than 20 000 picocuries per liter (pCi/L), the federal limit for tritium in drinking water. The plan must include measures to prevent tritium from moving from subsurface to surface, or to surface water on site.

9. ■ By August 1, submit a plan to the IEPA for reducing tritium activity in off-site groundwater to below 20 000 pCi/L.

10. ■ By December 1, submit to the IEPA a plan to reduce the threat to users of off-site groundwater to below 20 000 pCi/L.

11. ■ Notify the IEPA within 24 hours, with a written follow-up within five days, of radioactive material release to groundwater, surface water, or soil that is not allowed by the Braidwood license.

12. ■ Inform the public of tritium releases from Braidwood in keeping with a plan already approved by the IEPA.

The NRC inspection report lists five apparent violations and a preliminary "white" finding, although enforcement action was still pending and the NRC's significance determination process was still ongoing. The report states that following each leak during the period from 1996 through 2005, "the licensee failed to perform adequate radiological surveys to characterize the hazard and to assess the dose to the public and, for certain releases, to report the unplanned occurrences in required annual reports and to maintain records of the contamination for decommissioning purposes." The report notes that current environmental measurements show the calculated doses to area residents to be a very small fraction of the NRC limit and insignificant compared with background radiation. The report is available for download from the NRC's Web site, <www.nrc.gov>, through the ADAMS document retrieval system, with the accession number ML061450522.

MERGERS

NRC okays Exelon; Constellation on hold

There may be a trend toward the consolidation of major electricity providers, but that doesn't make the actual process of merging any easier. The merger of Exelon with Public Service Enterprise Group (PSEG) has taken much longer than either party expected, and while the Nuclear Regulatory Commission approved the necessary license transfers of PSEG reactor ownership shares on May 30, the merger is still being contested before state authorities in New Jersey. And on May 31, Constellation Energy officials notified employees that active planning of its merger with FPL Group is being put on hold although the merger review process (gaining the necessary state and federal approvals) was said to be continuing.

Because both PSEG and Exelon are power reactor owner-operators of long standing, the issue of whether the licenses could be transferred to the control of the proposed new company, Exelon Electric and Gas, was not seen as controversial within the NRC. PSEG is the licensee of the Hope Creek and Salem reactors in New Jersey and has held an ownership share of Exelon's Peach Bottom plant. The NRC has approved the transfer of PSEG's license responsibilities for these plants to Exelon (the current Exelon, not Exelon Electric and Gas), contingent on the transfer of decommissioning funds and adequate proof of insurance.

Constellation's planned merger with FPL—which would in fact be an acquisition by FPL, with the Constellation name retained in the merged company—was announced last December (*NN* Jan. 2006, p. 17). Constellation grew out of Baltimore Gas and Electric Company, and the merger proposal has been highly controversial in Maryland, where Constellation is seeking a residential rate hike of 72 percent. A statement from Constellation's chief executive officer, Mayo Shattuck, read, "While we still believe strongly in the proposed merits of our merger, we are disappointed in the ongoing political controversy in Maryland. While we remain hopeful that our merger with FPL can move forward, we think the prudent thing to do is put our integration efforts temporarily on hold while the political issues are being resolved." The "integration efforts" would include decisions on job dismissals and reassignments and the allocation of activities between the FPL and Constellation headquarters offices, both of which would be retained.

■ Constellation has also signed a memorandum of understanding with Electricité de France (EdF), under which the two companies are to work out a further agreement whereby EdF would assist Constellation in the development of the USEPR, the version of the European Pressurized water Reactor (EPR) intended for use in the United States. The USEPR effort, including the application for design certification by the NRC, is being carried out by UniStar Nuclear, a partnership of Constellation and Areva NP, the designer of the EPR. UniStar is also seeking to become builder/operator of a fleet of USEPRs, and Constellation has notified the NRC that it will apply in 2008 for a construction/operating license (COL) for a USEPR. The merger with FPL was announced after UniStar was launched, and FPL has made no public statements on whether it will participate in UniStar. FPL announced in April that it will apply for a COL in 2009, but did not specify the reactor design. NN

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
2443 WARRENVILLE ROAD, SUITE 210
LISLE, ILLINOIS 60532-4352

October 6, 2006

Mr. Joseph Cosgrove
Godley Park District
500 South Kankakee Street
Godley, Illinois 60407

Dear Mr. Cosgrove:

The purpose of this letter is to respond to a document that you provided to our NRC resident inspectors following the July 31, 2006, Braidwood End-of-Cycle Public Meeting. That document contained a number of questions concerning Braidwood radiological effluent releases and the Braidwood radiological liquid effluent release system. We have reviewed these questions and are providing the following information that addresses each of the questions that were contained in the document.

Question 1: Not just tritium is present in the plant's liquid-waste leaks and spills. No economically feasible technology exists to filter the tritium from the discharge (blowdown) water, so why and how could there be discharge water containing only tritium? That is, what is the source of water that allegedly contains tritium alone, with no other fission, corrosion, or activation isotopes present?

Answer: The Braidwood site discharges a mixture of tritium, corrosion, fission, and activation products in its routine liquid radioactive releases. The different radioisotopes and their relative mixtures can be examined by reviewing the licensee's Annual Radioactive Effluent Release Reports, which are available to the public through the NRC's document management system (ADAMS). The water that was inadvertently released through the blowdown line vacuum breaker valves consisted of the normal mixture of radionuclides commonly found in plant effluent discharges, which contained low levels of a number of radioactive isotopes.

The Braidwood radioactive waste treatment system contains a number of filtering units which are used to reduce the levels of many radioactive contaminants from the water prior to its discharge from the station. While it is absolutely accurate that "no economically feasible technology exists to filter the tritium from the discharge (blowdown) water," the licensee's main filtration systems (ion exchange resins and mechanical filters) are very effective in reducing most other radioisotopes from the discharge water. Using these systems, the concentration of non-tritium isotopes remaining in the discharge are maintained well below NRC requirements

The NRC and the licensee have detected only tritium in groundwater wells in the area of the Braidwood blowdown line leaks. The absence of other radioactive isotopes can be attributed to a number of factors:

- the effectiveness of the licensee's radioactive waste system for non-tritium isotopes;

- the flow of non-radioactively contaminated water in the blowdown line that provides a dilution factor of up to about 100; and

- the effectiveness of the soils and clays in the ground near the release points that also capture and retard the movement of non-tritium isotopes, such that they are not detectable in the groundwater.

In summary, the leaks from the Braidwood blowdown line were not comprised of only tritium. However, because of the low levels of other radioactive isotopes and the factors described above, only tritium has been detected in groundwater effected by the leakage.

Question 2: What permissible level of dissolved and entrained noble gases is allowed in the liquid effluent (in microCuries per milliliter or picoCuries per liter)? What is the lower limit of detection of each of the monitors that measure noble gases in liquid release releases?

Answer: The NRC's effluent release limits are primarily based on the potential dose to a member of the public from releases of material from NRC licensees. The NRC is continuously evaluating the latest radiation protection recommendations from international and national scientific bodies to ensure the adequacy of the standards the agency uses. Among those standards, the NRC and EPA have established three layers of radiation protection limits to protect the public against potential health risks from exposure to radioactive liquid discharges (effluents) from nuclear power plant operations.

Layer 1: 3 mrem per year ALARA objective - Appendix I to 10 CFR Part 50

The NRC requires that nuclear plant licensees must keep radiation doses from gas and liquid effluents as low as reasonably achievable (ALARA) to people offsite. For liquid effluent releases, such as diluted tritium, the ALARA annual offsite dose objective is 3 mrem to the whole body and 10 mrem to any organ of a maximally exposed individual who lives in close proximity to the plant boundary This ALARA objective is 3 percent of the annual public radiation dose limit of 100 mrem.

The NRC selected the 3 mrem and 10 mrem per year values because they are a fraction of the natural background radiation dose, a fraction of the annual public dose limit, and an attainable objective that nuclear power plants could meet. Power plants that meet these objectives are considered to be ALARA in reducing exposures to the general public from nuclear power plant effluents (AEC 1971, NRC 1975).

Nuclear power plant licensees must monitor the authorized releases (effluents) from their plants. If a given nuclear power plant exceeds half of these radiation dose levels in a calendar quarter, the plant licensee is required to investigate the cause(s), initiate appropriate corrective action(s), and report the action(s) to the NRC within 30 days from the end of the quarter. The NRC has not had any recent examples where a licensee was required to make such a report.

Layer 2: 25 mrem per year standard - 10 CFR 20.1301(e)

In 1979, EPA developed a radiation dose standard of 25 mrem to the whole body, 75 mrem to the thyroid, and 25 mrem to any other organ of an individual member of the public. The NRC incorporated these EPA standards into its regulations in 1981, and all nuclear power plants must now meet these requirements. These standards are specific to facilities that are involved in generating nuclear power (commonly called the "uranium fuel cycle"), including where nuclear fuel is milled, manufactured, and used in nuclear power reactors. The EPA determined the basis of the standards by comparing the cost-effectiveness of various dose limits in reducing potential health risks from operation of these types of facilities. The EPA assumed the standards would be able to be met for up to four fuel cycle facilities (e.g., four reactors) at one location (EPA, 1976a). Notably, the NRC's ALARA objectives are significantly lower than these EPA standards (NRC, 1980).

Layer 3: 100 mrem per year limit - 10 CFR 20.1301(a)(1)

The NRC's final layer of protection of public health and safety is a dose limit of 100 mrem per year to individual members of the public. This limit applies to all NRC licensees, including academic, university, industrial, and medical facilities that use radioactive material.

The NRC adopted the 100 mrem per year dose limit from the 1990 Recommendations of the International Commission on Radiological Protection (ICRP). The ICRP is an organization of international radiation scientists who provide recommendations regarding radiation protection-related activities, including dose limits. These dose limits are often implemented by governments worldwide as legally enforceable regulations. The basis of the ICRP recommendation of 100 mrem per year is that a lifetime of exposure at this limit would result in a very small health risk and is roughly equivalent to background radiation from natural sources (excluding radon) (ICRP, 1991). Thus, the ICRP equated 100 mrem per year to the risk of riding public transportation - a risk the public generally accepts (ICRP, 1977). The U.S. National Commission on Radiological Protection and Measurements (NCRP) also recommends the dose limit of 100 mrem per year (NCRP, 1993).

For liquid effluents, including tritiated water, a licensee can demonstrate compliance with the 100 mrem per year dose standard by not exceeding the concentration values specified in Table 2 of Appendix B to 10 CFR Part 20. These concentration values, if inhaled or ingested over the course of a year, would produce a total effective dose of 50 mrem. Many licensee's, including Braidwood, have an additional limit in the Offsite Dose Calculation Manual or Technical Specification that limits an individual release to 10 times the concentration values specified in Table 2 of Appendix B to 10 CFR Part 20. For dissolved or entrained noble gases, the concentration is limited to 2×10^{-4} microCuries per milliliter total activity for the Braidwood Site.

Braidwood Effluent Monitoring

The Braidwood Station has a final effluent radiation monitor (liquid radwaste effluent discharge monitor) installed in the discharge line before liquids enter the circulating water blowdown

piping. That monitor uses a sodium iodide detector that measures gamma emitting radionuclides that may be present in the liquid discharges. As designed (re. Updated Final Safety Analysis Report), the normal sensitivity of that monitor is 10^{-6} to 10^{-2} micoCuries per liter (depending on the energy level of the specific radionuclide). The monitor is not used by the licensee to quantify the radioactivity of the liquid discharge. Instead, the monitor provides a measure of assurance that abnormal, unexpected levels of radioactivity are not present in a discharge. The release tank discharge valves are designed to close on a high radiation signal from the discharge monitor.

The licensee's Offsite Dose Calculation Manual (ODCM) specifies the required sampling and analyses for radioactive discharges from the site, which the licensee uses to quantify its radioactive discharges. The Braidwood ODCM specifies the following for sampling and analysis of batch liquid releases:

Sampling Frequency	**Analysis Frequency**	**Type of Activity Analysis**	**Lower Limit of Detection (LLD) in microCuries/milliliter**
Each Batch Release	Each Batch	Principal Gamma Emitters	5×10^{-7}
		Iodine-131	1×10^{-6}
One Batch per Month	Monthly	Dissolved and Entrained Gases (Gamma Emitters)	1×10^{-5}
Each Batch	Monthly Composite	Tritium	1×10^{-5}
Each Batch	Quarterly Composite	Gross Alpha	1×10^{-7}
		Strontium-89 Strontium-90	5×10^{-8}
		Iron-55	1×10^{-6}

Question 3: How accurately can dissolved corrosion products and activation products be detected in samples of liquid effluents? For example, for which, if any of the following corrosion isotopes are radioassays specifically performed: cobalt-58 and -60; nickel-55, -57, and -63; manganese-54; and iron-59?

Answer: The accuracy of a measurement may be affected by a number of parameters, including the activity level of the sample, the sample collection techniques, and the radioactive background near the detector. Consequently, the NRC cannot specify a required sample accuracy that applies for all measurements. Instead, the licensees have specified lower limits of detection that must be met. For the radionuclides identified in the question, the licensee is required to perform an analysis for principle gamma emitters at the level defined in the Offsite Dose Calculation Manual (See NRC answer to Question No. 2) That analysis would provide a measurement of many of the radionuclides described in the question.

In the 1980s and 1990s, the NRC also implemented a confirmatory measurements program that compared the accuracy of the licensees' radioanalytical techniques to the NRC's measurements or to those of an NRC contract laboratory. The results of that program demonstrated that licensees, including the Braidwood Site, were capable of quantifying radioactivity in liquid and gaseous samples at an appropriate level of accuracy.

Question 4: Re Bullet #3 on p. 21: Assuming the NRC were to require a licensee to notify his state agency(ies) 28 days in advance of discharging tritiated water, what would be the estimated frequency of such notifications? Could the licensee perhaps have to notify the state on a daily basis?

Answer: The response to this question would be purely speculative. The frequency of any hypothetical notification would be dependent upon the terms of that requirement and how frequently the licensee discharges liquid radioactive effluents which satisfy those terms. Currently, the NRC does not require the licensee to notify the state in advance of discharging radioactive effluents to the environment nor is there any policy for such notifications under development.

In regards to the frequency of batch effluent releases from the Braidwood Site, the licensee's Annual Radioactive Effluent Release Reports are publicly available on the NRC's WEB site (via ADAMS). Those reports indicate the number of releases that occur at the station each calendar year (ADAMS Accession Nos. ML061210376 for the 2005 report; ML051300022 for the 2004 report, and ML041270044 and ML041830057 for the 2003 report). Historically, the licensee has discharged multiple batch liquid releases in the course of a week. For example, the licensee discharged 114 batch liquid releases in 2004 and 134 in 2005, which would average at about 2 - 3 batches per week or releases on 2 - 3 days each week.

Question 5: Bullet #6: As noted in the NIRS fact sheet, entitled "Are Federal Permissible Standards for Tritium Too Permissive?",* the NCRP and IAEA estimate the average amount of tritium found in natural water to be from **3 to 24 picocuries per liter**. What level of tritium has the NRC decreed to be the amount that "could be considered [to be] naturally occurring?

Answer: The NRC does not establish background levels (e.g., naturally occurring, nuclear weapons testing, radioactive fallout, etc.) for tritium or any other radionuclide The NRC does establish limits for radioactive effluents, which are described in our answer to Question No. 2.

Additional information concerning tritium can be found at :
http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/tritium-radiation-fs.html and
http://www.ead.anl.gov/pub/doc/tritium.pdf.

Question 6: Bullet #7: regarding the detection of tritium near (or below?) the Braidwood Turbine Building —

> (a) At what concentration level of tritium is the Turbine Building Drain Monitor set to detect? That is, what is the setpoint level of tritium that would trigger the alarm and initiate the automatic termination of releases to the environment?

(b) What is the monitor's Lower Limit of Detection for tritium?

(c) Is the Steam Generator Blowdown Monitor located in the Turbine Building?

(d) What is the Alarm/Trip Setpoint for tritium of the Steam Generator Blowdown Monitor? What is its lower limit of detection?

Answer: (a) The Turbine Building drains are collected in the Turbine Building Fire and Oil Sump. The Turbine Building Fire and Oil Sump has an inline radiation monitor that uses a sodium iodide detector. That type of detector is only capable of detecting gamma emitting radionuclides. Consequently, the monitor is not capable of detecting tritium in the effluents, nor is there a conventional inline monitor capable of detecting/measuring tritium.

(b) As stated above, the Turbine Building Fire and Oil Sump monitor is not capable of detecting tritium. However, the Turbine Building Fire and Oil Sump is discharged through the licensee's Waste Water Treatment system for release to the environment. The licensee has a composite sampler at the Waste Water Treatment Discharge to Circulating Water Discharge, which obtains a sample that is analyzed for tritium. That sample is analyzed on a monthly frequency for tritium to meet a required lower limit of detection of 1×10^{-5} microCuries per milliliter.

(c) The steam generator blowdown process radiation monitors are located in the Auxiliary Building. Once the blowdown flow passes the rad monitors, if no high radiation condition exists steam generator blowdown is sent into the Turbine Building to the steam side of the main condenser, otherwise it would be diverted to monitoring tanks in the Auxiliary Building.

(d) Similar to the liquid radwaste effluent discharge monitor, the steam generator blowdown monitors use sodium iodide detectors that measures gamma emitting radionuclides that may be present in the liquid discharges. As designed (re. Updated Final Safety Analysis Report), the normal sensitivity of that type of monitor is 10^{-6} to 10^{-2} micoCuries per liter (depending on the energy level of the specific radionuclide). The monitor is not used by the licensee to quantify the radioactivity of the liquid discharge. Instead, the monitor provides a measure of assurance that abnormal, unexpected levels of radioactivity are not present in the steam generator blowdown. The steam generator blowdown is diverted to the monitoring tanks on a high radiation signal from the monitor.

Question 7: Bullet #9, p. 22: Has Exelon submitted its proposed plan for diverting liquid wastes away from subsurface and surface water – that is, the liquid wastes contain tritium levels in excess of EPA's permissible drinking water level (20,000 picoCuries per liter)? Is the Exelon plan designed to cover only planned, batch releases of tritiated liquid wastes — or of continuous-flow releases, as well?

Answer: On April 4, 2006, the licensee submitted to the NRC its interim remediation plan to reduce the levels of tritium contamination in groundwater near the Braidwood Site That letter may be found in the NRC document management system (ADAMS accession number ML061020107) The licensee has not formally submitted to the NRC any plans to change its radioactive discharge system or release paths, as defined it its Offsite Dose Calculation Manual

and/or its Updates Final Safety Analysis Report Currently, the licensee's Offsite Dose Calculation Manual contains descriptions of the licensee's radioactive effluent release program, which includes both batch releases and continuous releases. In addition, the NRC has reviewed a change to the licensee's Offsite Dose Calculation Manual that provides for the release of contaminated liquid from a pond near the site boundary into the circulating water blowdown line, which is considered a continuous release path. The NRC's review of the licensee's interim remediation project was documented in NRC inspection report 05000456/2006003;05000457/2006003 (ADAMS ML062190402). The NRC has also reviewed the licensee's controls for batch releases of temporary storage tanks and for the continuous release of contaminated groundwater from onsite remediation groundwater wells.

Question 8: Bullet #11: Re releases to the environment that are "not allowed by the Braidwood license":

(a) Does the NRC allow a licensee's effluent water to contain a concentration of one million picoCuries per liter of tritium – that is, 1E-3 microCuries per milliliter, as per the Code of Federal Regulations, Title 10, Part 20, Appendix B, Table 2, Column 2? According to the introduction to App. B, one million pCi/L would produce a total effective dose equivalent of 50 millirem, if ingested continuously over the course of a year.

(b) Or can the effluent contain two million pCi/L of tritium, which would yield the NRC's permissible annual dose of 100 millirem, as per 10 CFR 20.1301(a)(1)?

Answer: (a) Yes. In general, NRC licensees may release effluents containing a concentration of tritium of 1,000,000 picoCuries per liter, which would result in doses to the public below the NRC's 100 millirem annual limit (unless the licensee has implemented lower administrative limits). As described in our answer to Question No. 2, the concentration values in Appendix B, Table 2, Column 2 to 10 CFR 20.1001 - 20.2402, if inhaled or ingested over the course of a year, would produce a total effective dose of 50 mrem. However, nuclear power licensee's are also held to the more stringent ALARA criteria, which is also described in the answer to Question No. 2.

(b) Yes. Section 12.3.1 of the Braidwood Offsite Dose Calculation Manual allows the licensee to release radioactive liquid effluents to the unrestricted areas (at any one time) at concentrations up to 10 times the concentration values in Appendix B, Table 2, Column 2 to 10 CFR 20.1001 - 20.2402, for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration is limited to 2×10^{-4} microCuries per milliliter total activity. Notwithstanding, the licensee still must maintain the total dose to the public below the limits discussed in our answer to Question No. 2 (discussed above). Essentially, this provision allows the licensee to release batches of liquids at the higher concentration (up to 10 times the Appendix B, Table 2, Column 2 level), so long as the annual doses are maintained within the ALARA criteria.

I want to assure you that NRC has and will continue to exercise strong oversight of radiological safety programs at all nuclear power plants. We appreciate your interest in these matters and are hopeful that this letter provides you with the information that was of interest to you

Sincerely yours,

Steven Orth, Health Physics Program Manager
Division of Reactor Safety