July 5, 2006

Mr. David Lochbaum
Director, Nuclear Safety Project
Union of Concerned Scientists
1707 H Street NW, Suite 600
Washington, DC 20006

Dear Mr. Lochbaum:

This is in response to the questions raised in your letter dated May 15, 2006, concerning the sampling program that we have been applying during NRC inspections at the Braidwood Nuclear Plant and other Illinois located reactor facilities. I have enclosed detailed information that addresses your questions and concerns. Be assured that the NRC is dedicated to protecting the health and safety of the public, including radioactive liquid released to the environment.

In response to the identification of recent radioactive liquid leaks and groundwater contamination, the NRC is inspecting all U.S. nuclear power plants as part of our normal inspection program to assess whether similar unplanned and unmonitored releases have occurred. As part of these inspections, the NRC has been obtaining licensee samples and independent samples at a number of facilities to provide additional verification of the adequacy of licensees' programs. As you identified in your letter, we began our sampling and analysis at the Braidwood facility very soon after the licensee identified elevated onsite tritium levels in groundwater samples. Following that discovery, the Region III staff obtained a number of groundwater and residential well water samples near the Braidwood facility. While a majority of those samples were obtained by the licensee and provided to NRC for independent analyses, other samples were independently collected by the NRC staff and analyzed by the NRC's contract laboratory.

The Region III staff applied a well developed and accepted method for comparing licensee and NRC sample results documented in NRC Inspection Procedure 84750, "Radioactive Waste Treatment, and Effluent and Environmental Monitoring," issued on March 15, 1994. Although replaced by the NRC's baseline inspection procedures, Inspection Procedure 84750 has remained an active procedure and was available for use as guidance in response to the Braidwood and Indian Point contamination incidents. We have enclosed a copy of that procedure for your convenience. The procedure contains defined acceptance criteria for sample comparisons that was prepared by the NRC and the U.S. Department of Energy's Radiological and Environmental Sciences Laboratory (RESL) and published in a report of the American Society for Testing and Materials (ASTM Special Technical Publication No. 698, 1980). The NRC used this method for several years in our radiological confirmatory measurements program.

The NRC's objective acceptance criteria is based on the resolution of the NRC's analytical results. The resolution is a measure of the precision of the measurement and is expressed as the ratio of the NRC's analytical result to its corresponding one sigma (1σ) uncertainty. The resolution is defined by the mathematical equation:

Resolution = NRC Analytical Result ÷ NRC Measurement Uncertainty
(The measurement uncertainty is the 1 one sigma (1σ) uncertainty.)

As the resolution increases, the NRC applies a much tighter acceptance band (Table 1).

The NRC applies an appropriate acceptance criteria to evaluate the licensee's results. The acceptance criteria is the acceptable ratios of the licensee to the NRC results (i.e., licensee result ÷ NRC result). We conclude that a licensee's measurement is in agreement with the NRC result if that ratio is within the acceptance criteria. Even though this method was developed almost 30 years ago, its development considered improvements in instrument response and sensitivity. Specifically, as instrumentation improves, the resolution would improve accordingly and a more restrictive acceptance criteria would then be applied to the measurement. Consequently, the method remains applicable with the advancements in instrument technologies.

The specific electronic mail (e-mail) message that you discussed in your correspondence described some preliminary measurements that we obtained from our contract laboratory. In the e-mail, Mr. Orth described the results as being preliminary. Mr. Orth's comments that the results were reasonably consistent were based on his application of the NRC acceptance criteria. The two sets of results reflected samples obtained from the same private well. Since the measurements were very low, the uncertainty associated with the measurements was quite large (2046 $\pm$ 300 picocuries per liter and 1230 $\pm$ 300 picocuries per liter), yielding resolutions of about 7 and 4, respectively. Mr. Orth applied our criteria and characterized the results as "reasonably consistent" in accordance with that criteria (Table 2). Later, we learned that the uncertainty reported by the laboratory was expressed as a 2 sigma error, which improved our resolution, but resulted in one of our comparisons becoming outside of our acceptance criteria. Concurrently, we had our laboratory re-analyze the samples, with increased counting times, and additional samples from the same source, which resulted in the comparisons documented in Table 3.

Table 1. Criteria for Accepting the Licensee's Measurements

Resolution (NRC Result/NRC Uncertainty)	**Acceptance Criteria** (Licensee Result/NRC Result)
< 4	Not Applicable
4 - 7	0.5 - 2.0
8 - 15	0.6 - 1.66
16 - 50	0.75 - 1.33
51 - 200	0.80 - 1.25
> 200	0.85 - 1.18

Table 2. Private Well Preliminary Comparison Data

Collection Date	**Licensee pCi/L**	**NRC (pCi/L)**	**NRC Sigma (pCi/L)**	**Resolution**	**Ratio**	**Agreement**
12-03-05	1151	2046	300	6.8	0.562	Agreement
12-06-05	1524	1230	300	4.1	1.239	Agreement

Table 3. Private Well Final Comparison Data

Collection Date	Licensee pCi/L	NRC (pCi/L)	NRC 2σ (pCi/L)	Resolution Based on 1σ	Ratio	Agreement
12-03-05	1151	1490	140.00	21.3	0.772	Agreement
12-06-05	1524	1020	130.00	15.7	1.494	Disagreement
12-08-05	1367	1360	140.00	19.4	1.005	Agreement
12-27-05		1310	140.00	18.7		
Arithmetic Mean	1347	1295	138	18.8	1.040	Agreement
Geometric Mean	1338	1283	137	18.7	1.043	Agreement

We are confident that our comparisons are based on sound analytical principles. While we recognize that larger variances are allowed at lower resolutions, the acceptance ranges are founded on sound technical bases. In cases of low resolution, the measurements are typically near the instrument detection limits, which results in greater uncertainty and more liberal acceptance ranges. Additionally, the dose calculated from these very low levels of contamination are very small fractions of a millirem. Consequently, the larger variances (based on instrument limitations) do not result in notable differences in the calculated doses, which remain far below the NRC dose limits.

In terms of your specific questions:

1.) What formal written procedure governs how the NRC staff obtains and evaluates split samples?

The NRC implements NRC Inspection Procedure 84750, as discussed above.

2.) What are the pre-established objective criteria employed by the NRC staff in evaluating the adequacy of split sample results?

The NRC uses an empirically derived criteria that is found in NRC Inspection Procedure 84750 and that has been modified as the program has been implemented. That criteria is discussed above and provided in Table 1.

3.) If there are no written procedures and no pre-established objective criteria, what are the rules-of-thumb shaping the NRC staff's "winging it"?

The NRC applies a pre-established, written procedure which has objective criteria, i.e., NRC Inspection Procedure 84750.

4.) If a 77 percent difference between point values and uncertainty bands that are not even close to overlapping is considered by the NRC staff to be "reasonably consistent," what pray tell would the NRC staff consider NOT to be "reasonably consistent"?

The NRC would consider results (ratio of licensee to NRC values) that are not within the acceptance criteria to be in disagreement and to require

additional review. As shown in Table 3, the value obtained on December 6, 2005, did not fall within the NRC acceptance criteria. The staff reviewed the values and recognized that the licensee's results were conservative, as compared to the NRC contract laboratory. In addition, the resolution was very near the lower band, indicating that the difference was likely due to the poor statistics of the measurements. In reviewing all of the sample results for the well, the NRC concluded that the licensee's results did not demonstrate any statistical bias and were overall in excellent agreement with the NRC contract laboratory (within 5 percent).

The NRC appreciates your interest in these matters. I 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 me.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of the NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA/

James L. Caldwell
Regional Administrator

Enclosure: NRC Inspection Procedure 84750, "Radioactive Waste Treatment, and Effluent and Environmental Monitoring," issue date March 15, 1994.

cc: S. Richards, NRR
A. Blough, RI
V. McCree, RII
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James L. Caldwell
Regional Administrator

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