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Washington, DC 20555-0001

Reference: (a) License No. DPR-3 (Docket No. 50-29)
(b) Letter, USNRC to YAEC, "Yankee (Rowe) Nuclear Power Station – Request for Additional Information Re: License Termination Plan (TAC No. L52095)," dated June 16, 2004.

Subject: Responses to NRC Requests for Additional Information – YNPS License Termination Plan (LTP)

The enclosure to this letter provides our responses to the requests for additional information (RAI) identified in Reference (b), as well as responds to the three additional questions which were provided at the meeting on June 9th. Where appropriate, the responses have been prepared as they would appear as changes to the LTP. The enclosed matrix identifies those LTP sections that will be revised for each of the RAIs. The revised LTP will be submitted separately in early September. Additionally, the revised Historical Site Assessment Report will be submitted by September 30, 2004. The correspondence which was requested by Reference (b) was provided at the June 9th meeting.

Should you have any questions regarding this information, please contact us.

Sincerely,

YANKEE ATOMIC ELECTRIC COMPANY

Gerard van Noordennen

Gerard van Noordennen
Regulatory Affairs Manager

Enclosures: Responses to NRC Request for Additional Information dated June 16, 2004
Matrix of RAIs and Associated Changes to the License Termination Plan
YAEC -1178, "Radionuclide Soil Concentrations Surrounding YNPS Resulting from Gaseous Releases during Plant Operation"

A001

YA-REPT-00-002-04, "Evaluation of Effluent Releases From Onsite Incineration of Waste"

"Values at or Above Lc for Gamma Emitting, Tritium, Gross Alpha, Gross Beta and Hard- to- Detect Radionuclides in Ground Water"

cc: J. Hickman, NRC, Senior Project Manager, NMSS
J. Wray, Inspector, NRC Region I (w/o enclosure)
S. Collins, Administrator, NRC Region I
R. Gallaghar, MA DPH
D. Howland, MA DEP
M. Rosenstein, EPA, Region 1
W. Perlman, Executive Committee Chair, FRCOG
T. W. Hutcheson, Chair, Franklin Regional Planning Board
L. Dunlavy, Executive Director, FRCOG
P. Sloan, Director of Planning & Development, FRCOG
D. Katz, CAN

Matrix of RAIs and Associated Changes to the License Termination Plan

RAI Number	Change to the LTP?	Location of Change(s)
1	Yes	Section 5.1
2	Yes	Section 5.1, last paragraph
3	Yes	Sections 1.6 and 5.4.1 under "Specify Tolerable Limits on Decision Errors"
4	Yes	Section 5.5.3.5, second paragraph
5	yes	Section 5.4.2, first paragraph
6	yes	Section 5.4.2, last paragraph; Section 1.6, paragraph under bullets
7	yes	Section 5.4.3
8	no	N/A
9	yes	Section 5.4.5.2, first paragraph under bullets
10	yes	Section 5.4.5.2, last paragraph
11	yes	Section 5.4.6.1, last paragraph
12	yes	Section 5.4.6.2
13	yes	Section 5.4.3.2, last two sentences deleted
14	yes	Section 5.5
15	yes	Section 5.5
16	yes	Section 5.5
17	yes	Section 5.5.3.5, second paragraph
18	yes	Section 5.5.1.2, sentence after two bullets and 5.4.4
19	yes	Section 5.1, last paragraph
20	yes	Section 5.4.3
21	yes	Section 5.5.2
22	yes	Section 5.5.3.3
23	yes	Section 5.5.3.3
24	yes	Section 5.4.2, last paragraph; Section 1.6, paragraph under bullets
25	yes	Section 5.5.3.5, second paragraph
26	yes	Section 5.5.3.5, fourth paragraph
27	yes	Section 5.1, last paragraph
28	yes	Section 5.1, last paragraph
29	yes	Section 5.1, last paragraph
30	no	N/A
31	yes	Section 5.6.2.3
32	yes	Section 5.6.2.4
33	yes	Section 5.6.2.4.4
34	yes	Section 5.6.2.4.4
35	no	N/A
36	yes	Section 5.6.3.2.2

RAI Number	Change to the LTP?	Location of Change(s)
37	yes	Section 2.6
38	No	N/A
39	yes	Section 5.7.2
40	yes	Section 5.7.5
41	yes	Section 5.7.5, last three sentences of section
42	yes	Section 4.2.1
43	no	N/A
44	yes	Section 4.3.2, last paragraph
45	yes	Table 4A-1
46	yes	Section 4A.2
47	no	N/A
48	no	HSA Section 7.3 will be revised
49	no	Revision to HSA is in process.
50	no	Revision to HSA is in process.
51	yes	A summary of the "Hydrological Report of 2003 Supplemental Investigation" will be added to LTP Section 2.
52	yes	See response to #51
53	yes	See response to #51
54	yes	See response to #51
55	yes	See response to #51
56	no	N/A
57	yes	A new table is being added to Section 6

Responses to NRC Request for Additional Information dated June 16, 2004

Question 1. (Page 5-1) Section 5.1, second paragraph, states that "advanced survey technologies may be used to conduct radiological surveys that can effectively scan 100% of the surface...". On page 5-17, it is noted that less than 100% coverage of survey units may occur. Text in Section 5.1 should state that less than 100% coverage may occur for Class 2 and 3 survey units.

Response: Section 5.1, second sentence will be revised to state, "...advanced survey technologies may be used to scan the surface and record the results.

Question 2. (Page 5-1) Section 5.1, second paragraph, discusses advanced survey technologies. Technical evaluations will be developed. Confirm that NRC will be given the opportunity to review the technical evaluations, and you will provide prior notification to the NRC before the use of alternate instruments or technologies.

Response: The NRC will be notified prior to the use of any alternate instruments or technologies and will also have the opportunity to review the technical evaluations that will programmatically document suitability and acceptability. Section 5.1 will be revised to state, "The technical evaluations will be referenced, as appropriate, in Final Status Survey Reports and will be available for NRC review. Notification will be made to the NRC prior to the use of advanced instruments or technologies."

Question 3. (Page 5-6) In the second paragraph under the bullet "Specify Tolerable Limits on Decision Errors", change the last sentence to "The following statement *will* [rather than may] be used as the null hypothesis at YNPS unless otherwise approved by the NRC: "The survey unit exceeds the release criteria." Change Section 1.6 to reflect NRC concurrence is needed to use other than this null hypothesis.

Response: A condition will be added in Section 1.6 to reflect the need for NRC concurrence to use a null hypothesis other than that stated above. The revision to page 5-6 will be made, as stated above.

Question 4. (Page 5-6) A Type I error of 0.05 (5%) is set in section 5.4.1. If double sampling is performed as proposed in Section 5.5.3.5, a smaller Type I error (e.g., 0.025) may be necessary for the initial survey design. See additional discussion in comment on Section 5.5.3.5. Please justify your proposal or revise.

Response: Section 5.5.3.5, paragraph 2, will be revised to state:

"For example, a Class 3 area that is subdivided due to the unexpected presence of radioactivity will be divided into at least two areas. One of these may remain as a Class 3 area while the other may be a Class 2 area. For the Class 3 area, either a new survey will be designed and implemented or the Type I and Type II errors will be adjusted and additional measurements made until the required number of measurements is met (see Section 5.5.1). NRC will be notified prior to subdividing a survey area. The Type I and Type II decision error rates will be documented in the final status survey report."

Question 5. (Page 5-7) The first paragraph of Section 5.4.2 states "The process described in LTP Section 1.6 will be used to evaluate the modifications to unit classifications to determine whether prior notification by the NRC is required." As it reads currently, "...prior notification by the NRC..." isn't really correct since notification is done by the licensee to the NRC. Please revise "by the NRC" to "to the NRC."

Response: The suggested revision will be made to 5.4.2 to state that notification will be made "to the NRC."

Question 6. (Page 5-8) Section 5.4.2, first paragraph following Table 5-1 must be consistent with Section 5.5.3.5, Re-survey. Changes are anticipated in Section 5.5.3.5 concerning subdividing survey units. Subdividing the survey units changes the statistical result. Please include a requirement for NRC notification prior to subdividing survey units.

Response: LTP Section 5.4.2 will be revised to add the following statement to the last paragraph: "The NRC will be notified at least 14 days prior to subdividing and/or reclassifying a survey unit/area to a less restrictive classification (as indicated in Section 1.6)." In addition, Section 1.6 will be revised to state, "Re-classification of survey areas from a less to a more restrictive classification (e.g., from a Class 3 to a Class 2 area) does not require prior NRC notification; however, re-classification to a less restrictive classification (e.g., Class 1 to a Class 2 area) and/or subdivision of a survey area will require NRC notification at least 14 days prior to implementation."

Question 7. (Page 5-8) Section 5.4.3 should provide the accuracy (and explanation as to the acceptability of that accuracy) of the GPS system.

Response: For locating samples, the GPS system that will be used at the YNPS site has sub-meter accuracy. Sub-meter accuracy is sufficient to establish a reproducible reference coordinate system and to physically locate sample points determined by the final status survey plan for an area. A benchmark is being established for daily pre-operational checks of the system. Information will be added to LTP Section 5.4.3 to state:

"The GPS to be used at the YNPS site has sub-meter accuracy. Sub-meter accuracy is sufficient to establish a reproducible reference coordinate system and to physically locate sample points."

Question 8. (Page 5-9) Section 5.4.4, third paragraph, discusses an alternative background determination method. This method may be used only with prior NRC approval. It is not clear if this is a conservative background determination method. This should not be the general or routine method for obtaining backgrounds. Provide further technical justification or remove.

Response: The "alternate method" of determining background within structures consists of observing the response of a beta-sensitive detector, when located near the center of the room.

YA-REPT-00-010-04 "Evaluation of Using a Gamma-Only Background Determination for Structures" shows calculated detector response in the beta-shielded condition for two contamination distributions of Co-60, Ag-108m, and Cs-137. The first assumed distribution is based upon site radioactive waste characterization data and the second assumes a conservative mix where all three radionuclides exist in equal fractions. This evaluation concluded that the detector gamma response at a distance of 3 ft from a 10 x 10 ft wall with deposited residual radioactivity at the DCGL (approximately the center of a 10 x 10 x 10 room) would be a small fraction of the detector response when in contact the wall surface. Thus, with the detector at least 3 ft from the wall, there is virtually no impact on the beta measurement when the associated values are subtracted (as background) from the beta measurements at the wall surface. The technical report documenting this evaluation is available for review at the site.

Question 9. (Page 5-12) Section 5.4.5.2, first paragraph after bullets, references two standard deviations above the FSS mean as a threshold to initiate an investigation. Explain the statistical basis for this threshold, and which data set the standard deviation comes from. It is not clear that the proposed threshold and associated survey(s) provide assurance equivalent to the FSS.

Response: The subject paragraph will be revised to state:

"...This re-survey will involve judgmental sampling of boundary and/or potential access points to the FSS area. If the results of the re-surveys indicate any measurement (DCGL fraction for land areas and bulk materials and static measurement for surfaces) is statistically greater than the initial FSS results (that is, measurement is > 2 standard deviations from the initial FSS mean), then an investigation survey will be conducted of the area..."

Question 10. (Page 5-12) Section 5.4.5.2, last paragraph should reference, specify, or describe the "specific radiological contamination levels" that are used to trigger an investigation survey.

Response: The specific levels are identified in the preceding paragraph on page 5-12 (and as described in the response to Question 10). To clarify, the sentence will be rewritten to state: "If the results of these surveys exceed the specific radiological contamination levels (i.e., measurement > 2 standard deviations from the initial FSS mean), an investigation survey will be conducted."

Question 11. (Page 5-14) Section 5.4.6.1, last paragraph discusses insignificant radionuclides and gives a citation to 10 CFR 20. However, 10 CFR 20.1204(g)(3) pertains to calculation of internal dose for occupational exposure, and the dose is still calculated on the total activity of the mixture. NUREG 1757, Vol. 2, Section 3.3, page 3-4 has a discussion of the treatment of insignificant radionuclides concerning pathway analysis and dose for decommissioning. The treatment in the LTP should be similar to that in NUREG-1757 or a justification needs to be provided.

Response: The text will be removed.

Question 12. (page 5-14) Section 5.4.6.2: may need more detail concerning DQOs for surrogate ratios. How (and how well) will ratios be determined? Will the ratio be checked to ensure it is representative during the FSS?

Response: The following will be added to LTP Section 5.4.6.2:

"It is an acceptable industry practice to assay a hard-to-detect (HTD) radionuclide by using an easy-to-detect (ETD) radionuclide as a surrogate. A common example would be to use a beta measurement to assay for a hard-to-detect alpha emitting radionuclide. Another example would be to relate a specific radionuclide, such as Cesium-137, to one or more radionuclides of similar characteristics. In such cases, to demonstrate compliance with the release criteria for the survey unit, the DCGL for the surrogate radionuclide or mix of radionuclides must be scaled to account for the fact that it is being used as an indicator for an additional radionuclide or mix of radionuclides. The result is referred to as the surrogate DCGL.

The following process will be applied to assess the need to use surrogate ratios for final status surveys (FSS).

- Determine whether HTD radionuclides (e.g., TRU, Sr-90, H-3) are likely to be present in the survey unit based on process knowledge and historical data or characterization.

- When HTD radionuclides are likely to be present, establish a relationship using a representative number of samples (typically six or more). The samples may come from another survey unit if the source of the contamination and expected concentrations are reasonably the same. These samples will be analyzed for ETD and HTD radionuclides using gross alpha, alpha spectroscopy, gross beta analysis, or gamma spectroscopy techniques.

Surrogate relationships will be determined using one of the methods described below.

- Develop a surrogate relationship for each HTD radionuclide.

$$DCGL_{surrogate} = DCGL_{ETD} \, x \, \frac{DCGL_{HTD}}{(f_{HTD:ETD} \text{ x } DCGL_{ETD}) + DCGL_{HTD}} \qquad \textit{(Equation 5-8)}$$

- Determine the average surrogate DCGL and the standard deviation from the surrogate relationships.

If the %CV (coefficient of variation) of the average surrogate DCGL is within 25%, then the average surrogate DCGL will be applied to the survey area. The %CV is the percent ratio of the standard deviation to the average surrogate DCGL. If this criterion is not met, the following steps will be applied.

- After a more detailed spatial analysis of the radionuclide mix distribution, the unit may be subdivided into separate survey units.

- The lowest surrogate DCGL from the observed radionuclide mix may be applied to the entire survey unit.

- Additional samples may be collected and analyzed to allow for a detailed analysis and documented evaluation of the radionuclide distribution in order to establish a DCGL specific to that survey unit.

- The surrogate DCGL may be computed from a simple recurrence formula :

$$\frac{C_{ETD}}{DCGL_{Surrogate}} = \frac{C_{ETD}}{DCGL_{ETD}} + \frac{C_1}{DCGL_1} + \frac{C_2}{DCGL_2} + \ldots + \frac{C_i}{DCGL_i}$$

or, for simplification

$$\frac{C_E}{D_{Surrogate}} = \frac{C_E}{D_E} + \frac{C_1}{D_1} + \frac{C_2}{D_2} + \ldots + \frac{C_i}{D_i}$$

where:

D_E	=	the DCGL for the easy-to-detect radionuclide
D_1	=	the DCGL for the first hard-to-detect radionuclide
D_2	=	the DCGL for the second hard-to-detect radionuclide
D_i	=	the DCGL for the i^{th} hard-to-detect radionuclide
f_1	=	the activity ratio of the first hard-to-detect radionuclide to the easy-to-detect radionuclide
f_2	=	the activity ratio of the second hard-to-detect radionuclide to the easy-to-detect radionuclide
f_i	=	the activity ratio of the ith hard-to-detect radionuclide to the easy-to-detect radionuclide

Consider the case of three HTD radionuclides from which a surrogate will be calculated.

$$DCGL_{Surrogate} = \frac{(D_E D_1 D_2 D_3)}{(D_1 D_2 D_3)+(f_1 D_E D_2 D_3)+(f_2 D_E D_1 D_3)+(f_3 D_E D_1 D_2)}$$

A general expression for the surrogate equation based on recursive relationships is provided by the following equation for n HTD radionuclides.

$$DCGL_{Surrogate} = \frac{D_E \prod_{i=1}^{n} D_i}{\prod_{i=1}^{n} D_i + D_E \sum_{i=1}^{n} f_i \prod_{\substack{m=1 \\ m \neq i}}^{n} D_m}$$

Question 13. (Page 5-15) Section 5.4.6.2, last two sentences: the contributions from all radionuclides, including insignificant contributors, must be accounted for in demonstrating compliance per NUREG-1757. Delete the last sentence or justify. See Question 11

Response: The subject text will be removed.

Question 14. (Page 5-16) Section 5.5, second bullet at bottom of page, gives ranges of scanning coverage for Class 2 survey units. Provide the methodology for deciding what the coverage will actually be for a Class 2 survey unit.

Response: The survey plan will include the basis for scanning coverage selected per plant procedures. Considerations in determining survey unit/area scanning coverage are based upon characterization, historical information and walkdowns. These considerations include:

- suspect areas (such as areas of system/structure removal or appearances that suggest the past presence of material storage or spills),
- potential for residual radioactivity relatively close to the DCGL, and
- any other indication of the potential for elevated activity below the DCGL.

Plant procedures include a requirement that the basis for the percent survey coverage shall be documented.

Section 5.5 will be revised to add the following information, under the bullets describing scanning coverage:

"The considerations used in determining the scanning coverage to be applied to survey unit/area include:

- the potential for suspect areas based upon historical information and walkdown,
- the potential for residual radioactivity relative to the DCGL, and
- any other indication of the potential for elevated activity below the DCGL"

Question 15. (Page 5-17) Section 5.5: the text on this page describes in a general way how advanced survey techniques will be used. When 100% of the area is covered (as in Class 1 units), and assuming an adequate MDC, the advanced survey technique provides more complete spatial coverage than discrete measurements or samples. However, when less than 100% is covered, there will be some unsampled area. MARSSIM traditional methodology provides coverage over 100% of the area by a random-start systematic pattern, with statistical inference. Even 100 % of Class 3 areas are sampled randomly. The proposed substitution of advanced survey techniques for both the scan and fixed measurements/sampling does not provide adequate spatial coverage for Class 2 and 3 areas.

Response: The percent coverage requirements are provided in Section 5.5. The number of scan areas will be greater than 15 (corresponding to the minimum number of samples for α=0.05 and β=0.05). The location of the scan area will be determined by using the guidance in Section 5.5.1.6. The size of the scan area is determined by the size of the survey area, the percent survey coverage, and the number of scan areas. LTP Section 5.5 will be revised to include this information.

Question 16. (Page 5-17) The last bullet discusses surveys that combine advanced techniques with traditional methods. Provide more detail as to how the number of traditional measurements/samples will be determined for the areas not assessed with the advanced technique, and how statistical tests will be performed. Technical basis documents addressing the acceptability of the use of advanced technologies will address the application of statistical tests to the data collected.

Response: See the response to Question 15 that describes the number of measurements to be taken. Any measurement results that exceed the $DCGL_W$ will require investigation per Section 5.5.3.2.

Question 17. (Page 5-18) Section 5.5.1.1 sets α at 0.05. Note that the double sampling proposed in Section 5.5.3.5 will increase α to greater than 0.05. If the licensee retains the provision for double sampling, α should be set to 0.025. See Question #4.

Response: See response to Question #4.

Question 18. (Page 5-19) Section 5.5.1.2, sentence after the two bullets: as noted in the comment for page 5-9, Section 5.4.4, parameters for backgrounds should not be taken from the survey area. Add a sentence emphasizing that the reference areas will not be in the survey area unless NRC approval is obtained.

Response: The sentence will be revised to state:

"Values of σ_r will be computed using data collected from measurements in reference areas or from reference materials (typically outside of the survey area or unit), as appropriate."

Section 5.4.4 will be revised to add the following sentence to the third paragraph of 5.4.4:

"If this alternate method is to be used, the NRC will be notified of YAEC's intent 14 days prior to implementation."

Also see the response to Question #8.

Question 19. (Page 5-24) In the paragraph following Equation 5-15, it is stated that if a method of calculating MDC is different than MARSSIM, a technical evaluation will be available for NRC inspection. Notification to the NRC should be made prior to implementation.

Response: See response to Question #2.

Question 20. (Page 5-26) Section 5.5.1, last paragraph: the accuracy and suitability of the GPS system should be provided somewhere. (Essentially the same comment as for Section 5.4.3, page 5-8). See Question #7.

Response: See the response to Question #7.

Question 21. (Page 5-27) Section 5.5.2, first paragraph at top of page: Specify the number, percentage, or other DQO that quantifies how many samples will be taken to confirm the radionuclide mix.

Response: FSS procedures specify the percentage and/or number of samples that need to be analyzed when evaluating a radionuclide mix. The process relies on a graded approach that depends upon the activity levels present. This procedure will be available onsite for NRC review.

The last three sentences of LTP Section 5.5.2 will be revised to state, "FSS procedures specify the percentage and/or number of samples that need to be analyzed when evaluating a radionuclide mix. The process relies on a graded approach that depends upon the activity levels present. This procedure will be available onsite for NRC review."

Question 22. (Page 5-28) Section 5.5.3.3 discusses remediation. Provide examples of "other reasons" that cause removal of materials that would not be considered remediation.

Response: Examples of other reasons that would cause removal or materials but would not constitute "remediation" could include: removal of materials associated with decommissioning activities, removal of soils for use as fill in a different area of the site, removal of materials for worker ALARA considerations, or removal of materials for non-radiological remediation (e.g., removal of asbestos or PCBs).

The second sentence of Section 5.5.3.3 will be revised to state, "Activities to remove materials may be performed for other reasons (such as removal of materials associated with decommissioning activities, removal of soils for use as fill in a different area of the site, removal of materials for worker ALARA considerations, or removal of materials for non-radiological remediation), and thus are not considered to be 'remediation.'"

Question 23. (Page 5-28) Section 5.5.3.3 does not discuss the possibility that remediation may also be necessary to meet the requirement for the average concentration above background to be less than the $DCGL_W$, not just those spots above the $DCGL_{EMC}$. Please address this issue.

Response: The section will be revised to add the following: "If during the time of the Final Status Survey, the survey area is found not to "pass" or any areas of residual activity are found to be in excess of the $DCGL_{EMC}$, remediation will be performed."

Question 24. (Page 5-29) Section 5.5.3.4 allows subdividing a survey unit and reclassifying the parts. While a whole unit could be re-classified from a less restrictive to more restrictive classification without prior NRC approval, subdividing a failed unit has a potential impact on the Type 1 decision error (as well as raising questions concerning the original classification methodology) and so should be done only with prior NRC approval.

Response: As discussed in the response to Question #6, notification will be made to the NRC prior to implementing the subdivision or the reclassification of an area to a less restrictive class.

Question 25. (Page 5-29) Section 5.5.3.5 proposes a re-survey methodology that is essentially double sampling. Double sampling can double the Type I decision error. In some cases, double sampling may be acceptable if a smaller Type 1 error was used for the initial survey design. If the original survey uses a Type 1 error of 0.05, the proposed additional sampling of the subdivided "cleaner" area would result in an increase of the Type I error to greater than 0.05 and would require NRC approval. See also Questions 4 and 17.

Response: See response to Question #4.

Question 26. (Page 5-29) Section 5.5.3.5, last paragraph: This case (remediation of a small area of a Class 1 survey area and subsequent limited survey) could only be performed if the survey unit passed on the Wilcoxon or Sign test.

Response: The fourth paragraph of Section 5.5.3.5 will be revised to state:

"If an area has passed the WRS or Sign Test and additional clean-up is required in only a small area of a Class 1 survey unit (e.g., for ALARA purposes), any replacement measurements or samples required will be made within the remediated area at randomly selected locations following verification that the remediation activities did not affect the remainder of the unit..."

Question 27. (Page 5-32) Section 5.6.1.3, last paragraph: NRC notification should be made prior to using advanced survey technologies. See also Question #2.

Response: See response to Question 2.

Question 28. (Page 5-32) Section 5.6.1.4: NRC notification should be made prior to using advanced survey technologies. See also question #2.

Response: See response to Question 2.

Question 29. (Page 5-32) Section 5.6.1.4, last paragraph: While a calibration using one geometry may be extended to others by modeling, the requirement that the measured configuration matches the assumed (modeled) configuration exists. Often, much more data is needed concerning the materials close to the source (such as shield densities, thicknesses, and composition). A source distribution is also assumed. These factors and associated quality assurance will need to be addressed in a technical support document submitted to the NRC prior to implementation.

Response: See response to Question 2.

Question 30. (Page 5-32) Section 5.6.1.5: A nominal or minimum sample size (mass) and depth should be specified, as well as procedural details such as removal of extraneous material and handling.

Response: Approved site procedures address details such as sample size and depth, as well as other details. One procedure specifically requires that undesirable vegetation, debris and rocks be removed while sampling. This procedure further specifies that a 1-liter or 500 gram sample be used for radionuclide analysis. These procedures are available onsite for NRC review.

Question 31. (Page 5-35) Section 5.6.2.3: "adjusted" data must be documented and noted as such in the FSS Report. The technical basis and rationale for the adjustment must be provided for review.

Response: FSS procedures require that all adjustments to data be documented in the FSS reports. LTP Section 5.6.2.3 will be revised to include this statement.

Question 32. (Page 5-35) Section 5.6.2.4: The statement "Instruments and methods used for field measurements will be capable of meeting the investigation level in Table 5-2" is less limiting than the third paragraph on page 5-17 (10-50% of the DCGL). Please resolve this discrepancy.

Response: The statement in section 5.6.2.4 is intended to be a more general statement than that of page 5-17. The statement in section 5.6.2.4 will be clarified as follows.

"Instruments and methods used for field measurements will have minimum detection capabilities that are lower than the investigation levels in Table 5-2, as discussed in section 5.5"

Question 33. (Page 5-38) Section 5.6.2.4.4, first paragraph, second sentence: If larger NaI detectors...are used, then the scan MDC will be computed using...MARSSIM. Please commit to documenting the computation of the scan MDC.

Response: All MDC calculations are documented in accordance with site final status survey procedures. A statement that "the computation of MDCs will be documented" will be added.

Question 34. (Page 5-38) Section 5.6.2.4.4, second paragraph, last sentence: Demonstrate the alternate method of determining the scan MDC is conservative.

Response: The example on pages 5-21 and 5-22 provides the calculation of MDC as a function of DCGL. To illustrate the concept, this example has been expanded to calculate the MDC of each constituent.

The soil scanning MDC expressed as a fraction of the $DCGL_{EMC}$ is calculated by the following equation:

$$MDC(fDCGL_{EMC}) = MDCR\sum\frac{f^i}{E^i DCGL^i_{EMC}} = MDCR\sum\frac{f^i}{E^i AF^i DCGL^i_W} \quad \text{(Equation 5-7)}$$

Where f^i is the decimal fraction of the radionuclide mix comprised by radionuclide i and is based upon characterization data, as a part of the Final Status Survey.

An example calculation to determine the soil scanning MDC expressed as a fraction of the $DCGL_{EMC}$ when multiple radionuclides are present is shown below:

Assumptions:

Two radionuclides are present; Cs-137 and Co-60
Cs-137 fraction in mix (f) = 0.75
Co-60 fraction in mix (f) = 0.25
Cs-137 efficiency (E) = 228 cpm/pCi/g
Co-60 efficiency (E) = 882 cpm/pCi/g
Elevated area = 100 m^2
Example Cs-137 area factor (AF) = 2.93
Example Co-60 area factor (AF) = 1.41
Example Cs-137 $DCGL_W$ = 7.91 pCi/g
Example Co-60 $DCGL_W$ = 3.81 pCi/g
MDCR = 2,000 cpm

$$MDC(fDCGL_{EMC}) = 2{,}000\left[\frac{0.75}{(228)(2.93)(7.91)} + \frac{0.25}{(882)(1.41)(3.81)}\right] = 0.4$$

However, if the MDC is calculated based upon each radionuclide separately, we find:

For Cs-137,

$$MDC(fDCGL_{EMC}) = 2{,}000\left[\frac{1}{(228)(2.93)(7.91)}\right] = 0.38$$

For Co-60,

$$MDC(fDCGL_{EMC}) = 2{,}000\left[\frac{1}{(882)(1.41)(3.81)}\right] = 0.42$$

Using the MDC that represents the higher fraction of the DCGL (that is, the MDC for Co-60 which is equal to 0.42) represents a worse case than use of the MDC based upon the mix (0.4), as it assumes that the minimum contamination that one can "see", when compared to the DCGL, is a larger fraction than the MDC associated with the mix.

Thus, selecting the highest MDC of the radionuclide constituents will result in a more rigorous final status survey design, and therefore, is more conservative. This last statement will be added to the end of the second paragraph of Section 5.6.2.4.4.

Question 35. (Page 5-44) Section 5.6.3.2.2 states that 25 locations in the industrial area will be sampled initially for subsurface contamination. Please provide the rationale for this number.

Response: The use of twenty-five locations applies only to final status survey. The value of 25 is in the range of the values for N for the Sign test, or N/2 for the WRS test (15 to 30), corresponding to $\alpha = 0.05$, $\beta = 0.05$, and $1.0 \leq \Delta/\sigma \leq 3.0$. These are the values for α, β, and Δ/σ committed to in the LTP. All samples will be evaluated against the soil DCGLs by using either the Sign or WRS test.

At the time of FSS, samples will have been taken in the industrial areas for purposes such as remediation support and characterization. In addition, samples taken to support non-radiological remediation and characterization may also be analyzed for radiological constituents. Thus, the total number of subsurface samples being collected and analyzed for radiological constituents will far exceed the 25 taken for purposes of FSS.

Question 36. (Page 5-44) Section 5.6.3.2.2 states a minimum of 5% of the routine subsurface samples will be analyzed for hard-to-detect radionuclides. For other samples (e.g., surfaces soils), what fraction will be analyzed for hard-to-detect radionuclides? Is there additional information to support this percentage?

Response: It is noted that a minimum of 5% of surface soil samples will also be analyzed for HTDs. The following sentence will be added to the end of Section 5.6.3.2.2:

"A minimum of 5% of surface soil samples will be analyzed for hard-to-detect radionuclides."

The discussion of the 5% criterion is in the context of final status surveys. Analysis of samples from other surveys (e.g., remediation and characterization) will also include HTDs. The use of 5% is consistent with the approved approach taken by CYAPCO in analysis of subsurface soils at the Haddam Neck Plant.

Question 37. (Page 5-44) Section 5.6.3.2.2 indicates that 3-meter subsurface samples will be homogenized over the entire depth of the core. Homogenizing over 1-meter lengths or less provides more information on the vertical distribution of radionuclides. Please justify 3-meter homogenization.

Response: Homogenization over the 3-meter core is only being proposed at the time of final status survey. Homogenization of the 3-meter core provides a condition that is consistent with the assumptions in the dose modeling calculations for soil, and thus is appropriate for final status survey. However, sampling for purposes of characterization may include segregating the core into smaller increments, based upon measurements from field screening techniques.

The following two sentences will be added to the beginning of the third paragraph of Section 2.6:

"Subsurface investigations will include collection of soil cores. Evaluation of these cores may include segregating them into smaller increments, based upon measurements from field screening techniques."

Question 38. (Page 5-46) Section 5.7 addresses only the traditional type of surveys. It is not clear how data from traditional methods combined with advanced methods, or data from advanced methods alone, will be evaluated.

Response: In the case of combined traditional and advanced methods, any measurements from advanced technologies or samples from traditional methods in excess of the $DCGL_W$ will require investigation per Section 5.5.3.2. Data from advanced methods alone will be treated as discussed in the response to Question 16.

Question 39. (Page 5-50) Section 5.7.2, second paragraph from top: elaborate on which "actual values" will be assigned to "less than MDC" data for the Sign Test.

Response: In the event that laboratory analysis results are provided as "less than MDC", the actual values will be obtained from the laboratory and used in the application of the Sign test. The statement in Section 5.7.2 will be clarified to read:

"Though it is not anticipated, if any of the data collected from a final status survey are reported as 'less than MDC' or as background, actual values (obtained from the laboratory) will be assigned, even if negative, for purposes of applying the Sign test."

Question 40. (page 5-51) Section 5.7.5, second paragraph references MARSSIM Sections I.9 and I.10 concerning retrospective power analyses. Section I.10 presents spreadsheet formulas and does not deal with power analyses.

Response: The references should be "Sections I.9.1 and I.9.2" rather than "Sections I.9 and I.10" currently reflected in the LTP text. This typographical error will be corrected as indicated above.

Question 41. (Page 5-51) Section 5.7.5, last sentence: Depending on the survey design, a new survey may also increase the Type 1 error and would, therefore, also require concurrence by the regulator. Please revise the statement accordingly or justify why not.

Response: The final three sentences of page 5-51 will be revised to state:

"As another example, the assessment determines that additional samples are necessary to provide sufficient power or to resample the survey unit with a new (and appropriate) number of samples and/or survey design. Note, this method may increase the Type I error; therefore, agreement with the regulator will be necessary prior to implementation."

Question 42. (Page 4-2) Section 4.2.1: Please commit to NRC notification prior to backfill of excavations or justify why not.

Response: LTP Section 4.2.1 will be revised to add the following paragraph:

"Excavations will be surveyed (either to FSS criterion, as discussed in Section 5, or to the "no detectable radioactivity" criteria) following soil removal for radiological remediation. The NRC will be notified, through routine communications, of YAEC's intent to backfill excavations."

Question 43. (Page 4-3) Section 4.2.3: Is "no remediation of groundwater" still true given more data on the tritium plume?

Response: Levels of tritium continue to decrease, as observed in well monitoring data. Data also indicate that the levels are likely to meet the MCLs at the time of license termination (due to decay and natural attenuation), and thus, remediation is not likely to be required.

Question 44. (Page 4-4) Section 4.3.2: last paragraph: provide justification for (or the source of) the statement "The ALARA criterion is met by performing the action and not necessarily by achieving results below the specified action level", and also the next sentence.

Response: The statement in question was taken from DG-4006. YAEC recognizes that this language is not included in the current guidance in NUREG-1757, although it believes that the intent of the guidance has not changed. However, Yankee will revise this portion of the LTP to state:

"The action levels represent the radioactivity concentrations at which a clean-up action is cost beneficial. The ALARA criterion is met by demonstrating that the residual radioactivity is already below the action level or by performing the action. An ALARA analysis ensures that the efforts to remove residual contamination are commensurate with the risk that exists with leaving the residual contamination in place. However, the residual contamination must be low enough to assure the annual dose to the average member of the critical group does not exceed 25 mrem/yr TEDE."

Question 45. (Page 4A-3) Table 4A-1 change parameter "R" to "r".

Response: The noted typographical error will be corrected.

Question 46. (Page 4A-5) last paragraph: Additional discussion is needed concerning meeting ALARA criteria by performing a cleanup action as opposed to achieving cleanup goals.

Response: As indicated in the response to Question #44, the language is reflective of prior NRC guidance. The following text will be added to the last paragraph of Section 4A.2:

"As previously noted, the ALARA criteria are met by demonstrating that the residual radioactivity is already below the action level or by performing the clean-up action, not by achieving results below a specific ALARA action level. An ALARA analysis ensures that the efforts to remove residual contamination are commensurate with the risk that exists with leaving the residual contamination in place."

Question 47. HSA Section 8 references: provide Ref. 15 (YRC-1178)

Response: YRC-1178 is provided as an attachment to this response. A supplement to this report, YA-REPT-00-002-04 is also included as it provides further evaluation of the original report.

Question 48. HSA Vol. 1 (Page 7-4) Section 7.3 references Section 7.2.2; should this be 7.3.2?

Response: Yes, the reference contains a typographical error. This error will be corrected in Revision 1 to the HSA.

Question 49. HSA Vol. 1 (page 7-6) paragraph preceding Section 7.3.1:

"In examining the SOF values on Table 7-4, it is evident that the use of the interim DCGLs would not result in any reclassifications for all class 2 and 3 survey areas given the reasonably close agreement between these DCGLs and the low SOF values shown for the survey areas.

Therefore, modification of the comparison basis to the final proposed DCGLs is not needed since this data provides ample substantiation of the classification performed only by historical basis."

Comment: More discussion is needed on possible reclassification due to smaller DCGLs. The criteria for classification are not presented quantitatively, so it is not evident that the smaller final DCGLs do not cause some previously Class 3 areas to be Class 2. In addition contributions form tritium and Sr-90 must be added if present. An additional concern is that the dose contribution from insignificant radionuclides may not have been factored in (see comment for page 5-14, Section 5.4.6.1). Some areas that are classified as Class 3 (for example, OOL-01, OOL-03, and OOL-08) will have a maximum SOF that is close to or greater than 0.5. Table 7.4 should be augmented (or a new table created) with SOFs based on the final DCGLs and accounting for dose from insignificant radionuclides, tritium and Sr-90. (Conversely, subtraction of environmental background for Cs-137 will lower the SOF.)

Response: The SOF tables in the HSA were prepared with a preliminary DCGLs and in parallel with the development of DCGLs for submittal with the LTP the SOF tables in the HSA will be revised now that the finalized DCGLs are available.

Question 50. HSA OOL-02, p.4, current status ff, discusses OOL-08... need OOL-02 discussion.

Response: The HSA will be revised to include the correct status of survey area OOL-02.

Question 51. The licensee should provide groundwater potentiometric maps of the water-bearing units that have been or potentially may be impacted by site-generated radionuclides. The licensee should indicate groundwater flow directions on these maps and provide information on the hydraulic gradient. Additional potentiometric maps may need to be developed to represent seasonal or climatic changes in the water levels if these changes are significant.

Response: Ground water potentiometric maps for the shallow (stratified drift), intermediate depth (glaciolacustrine) and bedrock aquifers in July and November 2003 are provided in Figures 9 through 14 of the Hydrogeologic Report of the 2003 Supplemental Investigation of the Yankee Nuclear Power Station (YA-REPT-00-004-04). Ground water flow directions are shown on each map. The hydraulic gradient can be determined between any two points on each map by noting the ground water elevations at the points of interest and dividing the difference between these elevations (in feet) by the horizontal distance between the points (in feet).

It should be noted that, since the 2003 potentiometric maps were produced, YAEC has learned that ground water flow within the intermediate depth aquifer is more complex than depicted on the 2003 maps. We now believe that discrete aquifers comprised of relatively thin sand layers within the glaciolacustrine sediments each have unique potentiometric surfaces. Preliminary evaluation of more recent water level data indicates that the ground water flow direction in a sand aquifer at about the 30-foot depth is to the north, while flow in deeper sand at about 100 feet below grade is to the northwest.

Ground water levels have continued to be monitored in all available monitoring wells at the site on a quarterly basis since November 2003. Potentiometric maps for the shallow, intermediate depth and bedrock aquifers will be produced from these more recent quarterly data sets and will be provided in YAEC's next summary report of ongoing hydrogeologic investigations. Comparison of a chronological set of maps for each aquifer will provide an indication of seasonal fluctuations in ground water levels.

Section 2 of the LTP will be revised to add a summary of YA-REPT-00-004-04.

Question 52. The extent of the H-3 groundwater plume and of other potential site-generated radionuclide plumes should be adequately characterized, including horizontal and vertical dimensions and magnitude of radionuclide concentrations. This may require the installation of additional monitoring wells that are screened in the appropriate water-bearing units to delineate the extent of the radionuclide plume(s). The characterization of the plume(s) should also cover the development of hydraulic conductivity and storage values for the different water-bearing units.

Response: Maps showing the plan-view configuration and concentration of a tritium plume in the shallow aquifer in July and November 2003 are included as Figures 15 and 16 in YA-REPT-00-004-04. Similar maps for the tritium plume in the intermediate depth aquifer in July and November 2003 are provided in Figures 18 and 19 of the same report. Figures 5, 6, 7 and 8 of that report are cross sections showing the known extent and concentration of tritium vertically, in both the shallow and intermediate depth aquifers.

All monitoring wells in which plant-related radionuclides have been detected are sampled quarterly. Since July 2003, these ground water samples have been analyzed for a site-specific list of 24 radionuclides plus gross alpha and gross beta, which could have been produced by operation of the Yankee Nuclear Power Station, potentially released to the environment, and could potentially still be present on site. Other than tritium, none of these radionuclides have been detected in ground water samples.

Drilling of additional monitoring wells to further delineate the horizontal and vertical extent of the identified tritium plumes began June 22, and is expected to continue through the summer of 2004. Testing of the hydraulic conductivity of selected aquifers will take place later in 2004 into 2005, when demolition activities currently underway at the site are completed, and access can then be gained to those areas of interest that are currently unavailable.

Question 53. The licensee should discuss whether site-generated radionuclides have moved offsite (i.e., reached Sherman Pond, Deerfield River, or other locations) or discuss the potential for site-generated radionuclides to move offsite. The fate and transport of the radionuclides in the groundwater should be evaluated and discussed. The licensee should also provide the rates of groundwater transport and an estimate of the time for radionuclides in the groundwater to travel offsite.

Response: Figures 5, 6, 7, 8, 15, 16, 18 and 19 of YA-REPT-00-004-04, "Hydrogeologic Report of 2003 Supplemental Investigation," show the known extent of the tritium plumes. Data collected to date indicate that the only plant-related radionuclide, being transported from the site in ground water, is tritium. Additional monitoring wells are being installed during the summer of 2004 at the margins of the known tritium plumes, including the downgradient terminus, to characterize more completely the nature and extent of tritium in the ground water flow system. Routine sampling of these wells will be included in the ground water investigation program being implemented at the site.

A presumed source of tritium in ground water was one or more leaks in the SFP/IX Pit complex. The Spent Fuel Pit and IX Pit are adjacent and share a common wall. The Spent Fuel Pit was drained in June 2003, shortly after removal of the spent fuel. The IX Pit was drained and has remained empty since 1995. Currently, there are no sources of tritium-contaminated water that could contribute to an ongoing source of ground water contamination.

In December 1965 the concentration of tritium in Sherman Spring was 7.2 E+6 pCi/L. This level was the result of a known release of tritium from the IX Pit discovered in 1963 and repaired in 1965. Given this relatively high concentration of tritium in Sherman Spring, it is reasonable to assume that tritium was transported to the Deerfield River (about 130 feet downgradient) in ground water sometime in 1966. However, the relatively high hydraulic conductivity of the impacted shallow aquifer has allowed approximately 16.5 aquifer volumes to pass through the ground water flow system since 1966.

The result of this process of natural attenuation is that tritium has generally decreased in concentration. Sherman Spring is routinely sampled, and generally, no plant-related radionuclides have been detected there since 1995. On this basis, no detectable tritium (or other radionuclides) is currently being discharged to the Deerfield River from the aquifer. The decrease in tritium concentration in Sherman Spring of more than 7 E +6 pCi/L since 1966 is considerably more than a 16.5-fold dilution and reflects the fact that the maximum concentration measured in 1966 was not uniformly distributed throughout the aquifer.

Under average ground water transport conditions, the rate of ground water flow in the shallow (stratified drift) aquifer is estimated to be about one foot per day. Assuming this rate of flow, the time required to transport tritium to the Deerfield River from the Spent Fuel/IX Pit Complex (approximately 850 feet) is about 2.3 years. Sherman Spring is about 730 feet downgradient from the Spent Fuel / IX Pit Complex, between the Complex and the Deerfield River. The tritium minimum detectable activity for the off-site laboratory used to analyze these samples is approximately 300 pCi/l.

YAEC will continue to monitor ground water concentrations throughout site demolition activities. It is possible that these activities may result in transients in aquifer flow and in tritium concentrations throughout the site. However, these conditions, if they were to occur, would stabilize well before license termination and future ground water monitoring activities would account for any transient effects.

Question 54. The relationship between groundwater and surface water should be examined and discussed.

Response: The general relationship between ground water and surface water at the site is that ground water from beneath and upgradient of the industrial area flows downgradient and discharges to the Deerfield River, which is the regional discharge point for ground water within the Deerfield River Valley. Figures 9, 10, 13 and 14 in YA-REPT-00-004-04 show the inferred ground water flow paths in the shallow and bedrock aquifers that discharge in the Deerfield River, in July and November 2003. As noted in the response to Question 51, we now believe that the potentiometric surface in the intermediate depth aquifer is not as shown in Figures 11 and 12 of YA-REPT-00-004-04, and revised maps for this aquifer will be provided in an upcoming summary report of the ongoing hydrogeologic investigation.

Question 55. The only groundwater sample results for site-generated radionuclides in the LTP are for H-3, gross alpha, and gross beta (Table 2-7). The concentrations and dates of sample collection for all site-generated radionuclides in the groundwater and surface water should be provided.

Response: Table 6 in YA-REPT-00-004-04 is a "Summary of Gamma Emitting, Tritium, Gross Alpha, Gross Beta, and Hard-to-Detect Radionuclides in Ground Water" for the third and fourth quarters 2003. Ground water samples have been collected for the first and second quarters of 2004. Analytical results have been received for the first quarter 2004, but analysis of the second quarter samples is not yet complete. Quarterly sampling of ground water will continue through 2004. To date, the gross alpha and beta detected are due to naturally-occurring radioactive materials and not plant-related radionuclides.

A summary of radiological analytical data for surface water is available from reports of the YNPS Radiological Environmental Monitoring Program (REMP).

Question 56. The dose contribution of the H-3 plume should be evaluated. Based on the results of the analysis, either a derived concentration guideline level (DCGL) can be created or, if the dose is less than 0.025 mSv/y (2.5 mrem/y), the H-3 dose contribution can be treated as insignificant as described in Section 3.3 of NUREG-1757, Volume 2. The dose contribution, as described in the guidance, would still count as part of meeting the dose limit.

Response: The calculation estimating the dose from groundwater at EPA's MCLs was provided to the NRC on April 27, 2004 (see YAEC letter BYR 2004-043).

Question 57. The LTP should be revised in Chapter 6 to include a common table displaying the DCGLs for soil, surfaces, and below-grade concrete. Additionally, the DCGLs for elevated measurements should be included in the revised Chapter 6.

Response: Area factors for soils and building surfaces are included in Appendix 6L and 6N, respectively. A common table providing the DCGLs for the different media will be added to Section 6.

NRC Request for Additional Groundwater Information (Email from Thompson to Hickman dated June 15, 2004)

Question 1. Table 1, Summary of Soil Sample Gamma Activity, gives results as <MDA for Co-60, Cs-134, and Cs-137. What is the MDA for each radionuclide?

Response: Table 1 should indicate "MDC" rather than "MDA." The MDCs for this data set are 1.5 E-1 pCi/g, 1.5 E-1 pCi/g, and 1.8 E-1 pCi/g for Co-60, Cs-134 and Cs-137, respectively.

Question 2. Table 2, Tritium Concentrations in Ground Water During Monitoring Well Drilling: What is the MDA for tritium?

Response: The analysis for tritium performed during drilling was performed onsite. The MDA for tritium for the onsite analyses is approximately 2,000 pCi/L.

Question 3. Table 6, Summary of Gamma Emitting, Tritium, Gross Alpha, Gross Beta, and Hard-to-Detect Radionuclides in Ground Water: I assume the units are pCi/L; is this correct? Also, it is rather time consuming to sift through the values. It would help if we could have this table provided electronically, or at minimum a hard copy with values above the Critical Level highlighted (perhaps by using conditional formatting).

Response: You are correct; the units for Table 6 are pCi/L. The attached table "Values at or Above Lc for Gamma Emitting, Tritium, Gross Alpha, Gross Beta and Hard-to-Detect Radionuclides in Ground Water lists those values from Table 6 which are greater than the Critical Level.

Values at or Above Lc for Gamma Emitting, Tritium, Gross Alpha, Gross Beta and Hard-to-Detect Radionuclides in Ground Water

Well ID and Sample Date	Suite A									
	Mn-54	Co-60	Nb-94	Ag-108m	Sb-125	Cs-134	Cs137	Eu-152	Eu-154	Eu-155
B-1										
July-03										
Nov-03	2.80E+00									
CB-1										
Aug-03										
Nov-03								7.40E+00		
CB-2										
Jul-03										
Nov-03										
CB-3										
Jul-03										
Nov-03	no sample									
CB-4										
Jul-03										
Nov-03										
CB-5										
Aug-03										
Nov-03	no sample									
CB-6										
Jul-03										
Nov-03								6.20E+00		
CB-7										
Aug-03										
Nov-03	no sample									
CB-8										
Aug-03										
Nov-03	no sample									
CB-9										
Aug-03										
Nov-03										

The Critical Level, Lc, is 1.645 times the standard deviation of the total counts.

Values at or Above Lc for Gamma Emitting, Tritium, Gross Alpha, Gross Beta and Hard-to-Detect Radionuclides in Ground Water

Well ID and Sample Date	Suite A									
	Mn-54	Co-60	Nb-94	Ag-108m	Sb-125	Cs-134	Cs137	Eu-152	Eu-154	Eu-155
CB-10										
Aug-03										
Nov-03										
CB-11A										
Aug-03										
Nov-03						3.20E+00				
CB-12										
Aug-03										
Nov-03										
CW-2										
Aug-03										
Nov-03	no sample									
CW-3										
Aug-03										
Nov-03										
CW-4										
Aug-03										
Nov-03	no sample									
CW-5										
Aug-03										
Nov-03	4.20E+00									
CW-6										
Jul-03										
Nov-03										
CW-7										
Jul-03										
Nov-03	no sample									

The Critical Level, Lc, is 1.645 times the standard deviation of the total counts.

Values at or Above Lc for Gamma Emitting, Tritium, Gross Alpha, Gross Beta and Hard-to-Detect Radionuclides in Ground Water

Well ID and Sample Date	Suite A									
	Mn-54	Co-60	Nb-94	Ag-108m	Sb-125	Cs-134	Cs137	Eu-152	Eu-154	Eu-155
CW-8										
Jul-03			1.74E+00							
Nov-03	no sample									
CW-10										
Aug-03										
Nov-03	no sample									
CW-11										
Aug-03										
Nov-03										
MW-1										
Aug-03										
Nov-03		4.70E+00								
MW-2										
Aug-03										
Nov-03		2.50E+00								
MW-5										
Jan-00										
Nov-03										
MW-6										
Aug-03										
Nov-03					7.70E+00				1.00E+01	
MW-100A										
Aug-03						2.40E+00				
Nov-03	no sample									
MW-100B										
Aug-03										
Nov-03	no sample									
MW-101B										
Sep-03										
Nov-03								5.60E+00		

The Critical Level, Lc, is 1.645 times the standard deviation of the total counts.

Values at or Above Lc for Gamma Emitting, Tritium, Gross Alpha, Gross Beta and Hard-to-Detect Radionuclides in Ground Water

Well ID and Sample Date	Suite A									
	Mn-54	Co-60	Nb-94	Ag-108m	Sb-125	Cs-134	Cs137	Eu-152	Eu-154	Eu-155
MW-101C										
Aug-03	3.10E+00							6.90E+00		
Nov-03					6.30E+00					
MW-102A										
Sep-03										
Nov-03					8.50E+00					
MW-102B										
Sep-03										
Nov-03	2.50E+00									
MW-102C										
Sep-03										8.60E+00
Nov-03										
MW-103A										
Aug-03			2.30E+00	2.50E+00						
Nov-03								5.60E+00		
MW-103B										
Sep-03										
Nov-03			2.40E+00				2.30E+00	5.10E+00		
MW-103C										
Sep-03					8.00E+00					
Nov-03										
MW-104B										
Aug-03	no sample									
Nov-03										
MW-104C										
Aug-03	no sample									
Nov-03										
MW-105B										
Aug-03										
Nov-03										

The Critical Level, Lc, is 1.645 times the standard deviation of the total counts.

Values at or Above Lc for Gamma Emitting, Tritium, Gross Alpha, Gross Beta and Hard-to-Detect Radionuclides in Ground Water

Well ID and Sample Date	Suite A									
	Mn-54	Co-60	Nb-94	Ag-108m	Sb-125	Cs-134	Cs137	Eu-152	Eu-154	Eu-155
MW-105C										
Sep-03										
Nov-03										
MW-107B										
Sep-03	no sample									
Nov-03									6.40E+00	
MW-107C										
Sep-03	no sample									
Nov-03										
MW-107D										
Sep-03	no sample									
Nov-03										
CFW-1										
Aug-03										
Nov-03										
CFW-2										
Aug-03										
Nov-03										
CFW-3										
Aug-03										
Nov-03										
CFW-4										
Aug-03										
Nov-03										
CFW-5										
Aug-03										
Nov-03										
CFW-6										
Aug-03										
Nov-03										

The Critical Level, Lc, is 1.645 times the standard deviation of the total counts.

Values at or Above Lc for Gamma Emitting, Tritium, Gross Alpha, Gross Beta and Hard-to-Detect Radionuclides in Ground Water

Well ID and Sample Date	Suite A									
	Mn-54	Co-60	Nb-94	Ag-108m	Sb-125	Cs-134	Cs137	Eu-152	Eu-154	Eu-155
CFW-7										
Aug-03										
Nov-03										
OSR-1										
Aug-03										
Nov-03	no sample									
Plant Supply Well										
Aug-03										
Nov-03	no sample									
Sherman Spring										
Aug-03										
Nov-03										
USGen MW-2										
Sep-03						2.10E+00				
Nov-03										
USGen MW-3										
Sep-03										
Nov-03										

The Critical Level, Lc, is 1.645 times the standard deviation of the total counts.

Values at or Above Lc for Gamma Emitting, Tritium, Gross Alpha, Gross Beta and Hard-to-Detect Radionuclides in Ground Water

Well ID and Sample Date	Suite B			Suite C				
	Tritium	Gross Alpha	Gross Beta	C-14	Fe-55	Ni-63	Sr-90	Tc-99
B-1								
July-03	1.36E+03	2.80E+00	9.16E+00					
Nov-03	9.00E+02		6.53E+00					
CB-1								
Aug-03	1.76E+03		1.35E+01					
Nov-03	2.14E+03		1.26E+01					
CB-2								
Jul-03	4.11E+02		1.62E+01					
Nov-03	1.16E+03		1.18E+01				2.30E+00	
CB-3								
Jul-03		4.50E+00	2.48E+01					
Nov-03								
CB-4								
Jul-03			1.41E+01					
Nov-03			8.20E+00	3.70E+01		8.80E+00		
CB-5								
Aug-03		1.54E+00	2.44E+00					
Nov-03								
CB-6								
Jul-03			1.90E+01					
Nov-03	4.30E+02		1.14E+01					
CB-7								
Aug-03			2.60E+01					
Nov-03								
CB-8								
Aug-03		3.90E+00	1.32E+01					
Nov-03								
CB-9								
Aug-03	2.33E+03		6.70E+00					
Nov-03	2.62E+03		7.60E+00					

The Critical Level, Lc, is 1.645 times the standard deviation of the total counts.

Values at or Above Lc for Gamma Emitting, Tritium, Gross Alpha, Gross Beta and Hard-to-Detect Radionuclides in Ground Water

Well ID and Sample Date	Suite B			Suite C				
	Tritium	Gross Alpha	Gross Beta	C-14	Fe-55	Ni-63	Sr-90	Tc-99
CB-10								
Aug-03	9.00E+02		1.91E+01		9.70E+00		2.51E+00	
Nov-03	1.21E+03		1.25E+01		5.90E+00			
CB-11A								
Aug-03			1.31E+01					
Nov-03	2.12E+02	8.70E+00	3.30E+01					
CB-12								
Aug-03		6.80E+00	2.81E+01					
Nov-03	5.40E+02		1.05E+01					
CW-2								
Aug-03		9.20E+00	4.25E+01					
Nov-03								
CW-3								
Aug-03			1.83E+01					
Nov-03	1.62E+02		5.91E+01					
CW-4								
Aug-03			1.77E+01					
Nov-03								
CW-5								
Aug-03			1.28E+01					
Nov-03		3.50E+00	6.60E+00					
CW-6								
Jul-03			1.10E+01					
Nov-03	1.58E+02		4.01E+00					
CW-7								
Jul-03		2.50E+00	1.13E+01					
Nov-03								

The Critical Level, Lc, is 1.645 times the standard deviation of the total counts.

Values at or Above Lc for Gamma Emitting, Tritium, Gross Alpha, Gross Beta and Hard-to-Detect Radionuclides in Ground Water

Well ID and Sample Date	Suite B			Suite C				
	Tritium	Gross Alpha	Gross Beta	C-14	Fe-55	Ni-63	Sr-90	Tc-99
CW-8								
Jul-03			1.11E+01					
Nov-03								
CW-10								
Aug-03		4.20E+00	1.16E+01					
Nov-03								
CW-11								
Aug-03	3.67E+03		8.60E+00					
Nov-03	1.85E+03		1.02E+01					
MW-1								
Aug-03		3.30E+00	3.39E+01				3.40E+00	
Nov-03	5.80E+02		2.21E+01		8.10E+00			
MW-2								
Aug-03	1.25E+03		8.30E+00					
Nov-03	1.78E+03		1.11E+01					
MW-5								
Jan-00	3.81E+03		9.00E+00					
Nov-03	2.99E+03		7.50E+00					
MW-6								
Aug-03		5.64E+00	1.05E+01					
Nov-03	2.14E+02	3.42E+00	8.90E+00					
MW-100A								
Aug-03		3.70E+00	1.02E+01					
Nov-03								
MW-100B								
Aug-03	2.50E+02	3.30E+00	1.31E+01					
Nov-03								
MW-101B								
Sep-03			3.90E+00					
Nov-03	2.52E+02	3.15E+00	1.27E+01					

The Critical Level, Lc, is 1.645 times the standard deviation of the total counts.

Values at or Above Lc for Gamma Emitting, Tritium, Gross Alpha, Gross Beta and Hard-to-Detect Radionuclides in Ground Water

Well ID and Sample Date	Suite B			Suite C				
	Tritium	Gross Alpha	Gross Beta	C-14	Fe-55	Ni-63	Sr-90	Tc-99
MW-101C								
Aug-03		9.20E+00	2.58E+01					
Nov-03			9.50E+00					
MW-102A								
Sep-03	4.58E+03		4.80E+00					
Nov-03	4.91E+03		2.71E+00					
MW-102B								
Sep-03	3.90E+02		5.20E+00					
Nov-03		1.60E+00	5.15E+00					
MW-102C								
Sep-03	5.75E+03		5.20E+00					
Nov-03	6.59E+03	2.13E+00	3.42E+00					
MW-103A								
Aug-03	3.50E+02	4.20E+00	1.28E+01					
Nov-03			9.35E+00					
MW-103B								
Sep-03		4.10E+00	8.90E+00					
Nov-03		1.79E+00	1.10E+01					
MW-103C								
Sep-03	2.70E+02	2.07E+00	1.07E+01					
Nov-03		5.10E+00	9.30E+00		5.90E+00			
MW-104B								
Aug-03								
Nov-03			1.13E+01				2.40E+00	
MW-104C								
Aug-03								
Nov-03			7.20E+00				2.00E+00	
MW-105B								
Aug-03	4.85E+03		1.13E+01					
Nov-03	5.22E+03	5.50E+00	1.28E+01		8.70E+00			

The Critical Level, Lc, is 1.645 times the standard deviation of the total counts.

Values at or Above Lc for Gamma Emitting, Tritium, Gross Alpha, Gross Beta and Hard-to-Detect Radionuclides in Ground Water

Well ID and Sample Date	Suite B			Suite C				
	Tritium	Gross Alpha	Gross Beta	C-14	Fe-55	Ni-63	Sr-90	Tc-99
MW-105C								
Sep-03	1.86E+03		9.32E+00					
Nov-03	3.72E+03	2.50E+00	8.20E+00					
MW-107B								
Sep-03	<2000							
Nov-03		2.70E+00	1.05E+01					
MW-107C								
Sep-03	4.80E+04							
Nov-03	4.58E+04		5.00E+00					
MW-107D								
Sep-03	9.15E+03							
Nov-03	9.71E+03		1.12E+01					
CFW-1								
Aug-03			2.97E+00					
Nov-03	2.66E+02	1.97E+00						
CFW-2								
Aug-03			7.37E+00					
Nov-03			3.10E+00					
CFW-3								
Aug-03			6.44E+00		1.01E+02			
Nov-03		1.93E+00	9.68E+00					
CFW-4								
Aug-03		2.70E+00	6.70E+00					
Nov-03		2.50E+00	8.80E+00					
CFW-5								
Aug-03			4.80E+00					
Nov-03		2.20E+00	5.20E+00					
CFW-6								
Aug-03			4.70E+00					
Nov-03			2.30E+00					

The Critical Level, Lc, is 1.645 times the standard deviation of the total counts.

Values at or Above Lc for Gamma Emitting, Tritium, Gross Alpha, Gross Beta and Hard-to-Detect Radionuclides in Ground Water

Well ID and Sample Date	Suite B			Suite C				
	Tritium	Gross Alpha	Gross Beta	C-14	Fe-55	Ni-63	Sr-90	Tc-99
CFW-7								
Aug-03			7.60E+00					
Nov-03		1.70E+00	2.60E+00					
OSR-1								
Aug-03			7.50E+00					
Nov-03								
Plant Supply Well								
Aug-03			3.89E+00					
Nov-03								
Sherman Spring								
Aug-03			9.98E+00					
Nov-03			6.30E+00					
USGen MW-2								
Sep-03	7.00E+02		1.08E+01					
Nov-03								
USGen MW-3								
Sep-03		1.75E+01	2.39E+01					
Nov-03								

The Critical Level, Lc, is 1.645 times the standard deviation of the total counts.

Values at or Above Lc for Gamma Emitting, Tritium, Gross Alpha, Gross Beta and Hard-to-Detect Radionuclides in Ground Water

Well ID and Sample Date	Suite D					
	Pu-238	Pu-239/240	Pu-241	Am-241	Cm-242	Cm-243/4
B-1						
July-03						
Nov-03						
CB-1						
Aug-03						
Nov-03		3.70E-01			5.60E-02	
CB-2						
Jul-03						4.30E-01
Nov-03						
CB-3						
Jul-03						
Nov-03						
CB-4						
Jul-03						
Nov-03						
CB-5						
Aug-03						
Nov-03						
CB-6						
Jul-03						
Nov-03			2.27E+00			
CB-7						
Aug-03						
Nov-03						
CB-8						
Aug-03						
Nov-03						
CB-9						
Aug-03			3.10E+00	2.80E-01		
Nov-03						

The Critical Level, Lc, is 1.645 times the standard deviation of the total counts.

Values at or Above Lc for Gamma Emitting, Tritium, Gross Alpha, Gross Beta and Hard-to-Detect Radionuclides in Ground Water

Well ID and Sample Date	Suite D					
	Pu-238	Pu-239/240	Pu-241	Am-241	Cm-242	Cm-243/4
CB-10						
Aug-03						
Nov-03						
CB-11A						
Aug-03						
Nov-03						
CB-12						
Aug-03						
Nov-03						
CW-2						
Aug-03						
Nov-03						
CW-3						
Aug-03						
Nov-03						
CW-4						
Aug-03						
Nov-03						
CW-5						
Aug-03						
Nov-03						
CW-6						
Jul-03						
Nov-03			8.60E-01			
CW-7						
Jul-03						
Nov-03						

The Critical Level, Lc, is 1.645 times the standard deviation of the total counts.

Values at or Above Lc for Gamma Emitting, Tritium, Gross Alpha, Gross Beta and Hard-to-Detect Radionuclides in Ground Water

Well ID and Sample Date	Suite D					
	Pu-238	Pu-239/240	Pu-241	Am-241	Cm-242	Cm-243/4
CW-8						
Jul-03						
Nov-03						
CW-10						
Aug-03						
Nov-03						
CW-11						
Aug-03				2.00E-01		
Nov-03						
MW-1						
Aug-03			3.10E+00			
Nov-03		1.60E-01	7.80E+00			
MW-2						
Aug-03						
Nov-03						
MW-5						
Jan-00						
Nov-03						
MW-6						
Aug-03						
Nov-03						
MW-100A						
Aug-03						
Nov-03						
MW-100B						
Aug-03		2.40E-01				
Nov-03						
MW-101B						
Sep-03						
Nov-03						

The Critical Level, Lc, is 1.645 times the standard deviation of the total counts.

Values at or Above Lc for Gamma Emitting, Tritium, Gross Alpha, Gross Beta and Hard-to-Detect Radionuclides in Ground Water

Well ID and Sample Date	Suite D					
	Pu-238	Pu-239/240	Pu-241	Am-241	Cm-242	Cm-243/4
MW-101C						
Aug-03						
Nov-03						
MW-102A						
Sep-03						
Nov-03						
MW-102B						
Sep-03						
Nov-03		1.90E-01				
MW-102C						
Sep-03						
Nov-03						
MW-103A						
Aug-03						
Nov-03						
MW-103B						
Sep-03						
Nov-03						
MW-103C						
Sep-03						
Nov-03						
MW-104B						
Aug-03						
Nov-03						
MW-104C						
Aug-03						
Nov-03		5.60E-01				
MW-105B						
Aug-03						
Nov-03						

The Critical Level, Lc, is 1.645 times the standard deviation of the total counts.

Values at or Above Lc for Gamma Emitting, Tritium, Gross Alpha, Gross Beta and Hard-to-Detect Radionuclides in Ground Water

Well ID and Sample Date	Suite D					
	Pu-238	Pu-239/240	Pu-241	Am-241	Cm-242	Cm-243/4
MW-105C						
Sep-03						
Nov-03						
MW-107B						
Sep-03						
Nov-03			2.79E+00			
MW-107C						
Sep-03						
Nov-03						
MW-107D						
Sep-03						
Nov-03						
CFW-1						
Aug-03						
Nov-03						
CFW-2						
Aug-03						
Nov-03						
CFW-3						
Aug-03			3.80E+00			
Nov-03						
CFW-4						
Aug-03						
Nov-03						
CFW-5						
Aug-03						
Nov-03						
CFW-6						
Aug-03						
Nov-03						

The Critical Level, Lc, is 1.645 times the standard deviation of the total counts.

Values at or Above Lc for Gamma Emitting, Tritium, Gross Alpha, Gross Beta and Hard-to-Detect Radionuclides in Ground Water

Well ID and Sample Date	Suite D					
	Pu-238	Pu-239/240	Pu-241	Am-241	Cm-242	Cm-243/4
CFW-7						
Aug-03						
Nov-03						
OSR-1						
Aug-03						
Nov-03						
Plant Supply Well						
Aug-03						
Nov-03						
Sherman Spring						
Aug-03						
Nov-03						
USGen MW-2						
Sep-03			2.02E+00			
Nov-03						
USGen MW-3						
Sep-03	2.60E-01					
Nov-03						

The Critical Level, Lc, is 1.645 times the standard deviation of the total counts.