

YANKEE ATOMIC ELECTRIC COMPANY

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November 23, 2005
BYR 2005-101

Robert Walker
Director, Radiation Control Program
Massachusetts Department of Public Health
90 Washington Street
Dorchester, Massachusetts 02121

Subject: Plan for Demonstrating Compliance with the 10 mrem/yr criterion of 105 CMR 120.291
at the Yankee Nuclear Power Station

Dear Mr. Walker:

This letter forwards Yankee Atomic Electric Company's (Yankee's) plan to demonstrate compliance with Massachusetts Department of Public Health (MADPH) Regulation 105 CMR 120.291, "Vacating Premises." It is noted that while the Yankee Nuclear Plant Station is not a radioactive material licensee for the MADPH, Yankee has committed to comply with this regulation in the Yankee Site Closure Project Plan (SCPP).

This Compliance Plan is consistent in approach with the License Termination Plan (LTP), submitted to and approved by the Nuclear Regulatory Commission, for license termination. The difference in the plans being the different dose limits: 25 mrem/yr as provided in 10 CFR 20.1402 and 10 mrem/yr as provided in 105 CMR 120.291. It is noted that a draft of this Compliance Plan was provided to your Mr. Mike Whalen for his review, and follow-up discussions were conducted to address questions and satisfy comments identified during that review.

Yankee respectfully requests a letter from the DPH, upon its review and acceptance of this plan, to acknowledge that the plan, implemented as written, will satisfy the requirements of 105 CMR 120.291. Please call Greg Babineau at (413) 242-2202 or myself at (310)-916-3995, if you have any questions regarding this document.

Very truly yours,

Alice Carson,
Licensing Manager
Yankee Atomic Electric Company

cc: Mike Whalen, MA DPH

Enclosure: As stated.

TECHNICAL REPORT TITLE PAGE

Demonstrating Compliance with DPH 10 mrem/yr Site Closure
Requirement for the Yankee Rowe Site

YA-REPT-00-021-04

Technical Report Number

Approvals

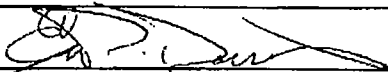
(Print & Sign Name)

Preparer: Alice Carson



Date: 11/23/05

Reviewer: Eric Darois



Date: 11/23/05

Approver (Cognizant Manager): G.M. Babincau



Date: 11/23/05

1.0 Introduction:

Yankee Atomic Electric Company's (YAEC's) site closure process for the Yankee Nuclear Power Station (YNPS) site will ensure that all applicable state and federal requirements with respect to radioactive and non-radioactive residual contamination will be satisfied. The License Termination Plan (LTP) provides the framework to address a sub-set of these requirements, namely the Nuclear Regulatory Commission's (NRC) requirements that must be met in order for the YNPS NRC Part 50 license to be terminated (10CFR50.92). YAEC is pursuing unrestricted release of the YNPS site, and accordingly the LTP has been written to address how the NRC's 25 mrem/yr Total Effective Dose Equivalent (TEDE) and "As Low As Reasonably Achievable" (ALARA) criteria in 10CFR20.1402 will be met. The NRC (along with the Department of Defense, the Department of Energy, and the Environmental Protection Agency) has developed detailed guidance to perform surveys to confirm that the criteria in 10CFR20.1402 have been met (referred to as "final status surveys"). This guidance is contained in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), NUREG-1575.

It is recognized that the NRC's criteria are not the only limits on residual radioactive contamination that the YNPS site must meet. The Massachusetts Department of Public Health (MADPH) also has limits on the amount of radioactivity (above background) that can be left at the site at the time of property transfer. The MADPH regulations, 105 CMR 120.291 Vacating Premises, states that "...the licensee...shall decontaminate the premises in such a manner that the annual total effective dose equivalent (TEDE) to any individual after the site is released for unrestricted use should not exceed ten millirem above background...". Even though the Yankee site is not a radioactive material licensee for the MADPH, Yankee has committed to comply with this regulation through the Yankee Site Closure Project Plan (SCPP).

This document presents the methods to be applied in demonstrating compliance with the 10 mrem criteria contained in 105CMR120.291. These methods incorporate the elements presented in the LTP for performing the final survey, given the unique aspects and conditions present at the Yankee site. The methods presented in this document are being incorporated into the site procedures governing the final status survey (FSS) activities, which are being made available for review by the MADPH, the Massachusetts Department of Environmental Protection (MADEP), and the NRC as needed.

2.0 Discussion:

For purposes of complying with the MADPH requirement of 10 mrem/yr TEDE, consideration of the following elements has been made:

- survey area classification,
- DCGL selection,
- final status survey design and implementation, and
- future dose contribution from groundwater.

Each of these elements is discussed in the following sections.

2.1 Survey Area Classification

The current revision of the NRC-approved LTP provides a summary of the Historical Site Assessment (HSA). The HSA represents a comprehensive compilation of radiological history and data for each area of the site and for each incident identified through plant records. This compilation was used to classify each survey area of the site according to the MARSSIM classification system. In accordance with MARSSIM, the classification of each area was conservatively based on the potential for residual radioactivity rather than on actual sample data. Thus, the survey area classification, as provided for in the LTP, will be used in the basis for performing the site surveys to meet the MADPH requirements.

2.2 DCGL Selection

Chapter 6 of the Yankee LTP includes the Derived Concentration Guideline Levels (DCGLs) for soil and building surfaces for twenty-two radionuclides. These DCGLs were calculated using the site-specific data, where available, supplemented with other conservative parameter values. A resident farmer scenario is used to determine DCGLs for site soil, and a building occupancy scenario is used to determine the DCGLs for standing buildings. The appendices of LTP Chapter 6 provide DCGLs for soil and building surfaces that correspond to an annual TEDE of 25 mrem. The LTP DCGLs are being scaled to meet 10 mrem/yr TEDE.

As explained in greater detail in Section 2.4, the dose contribution from groundwater pathways is subtracted from the 10 mrem/yr limit, for those scenarios involving groundwater pathways, to determine the DCGLs to be used in the Final Status Surveys. Groundwater pathways are included in the resident farmer scenario (used for site soils) but not for the building occupancy scenario (used for buildings to remain on site). Thus, the Building Surface DCGLs will correspond to a dose of 10 mrem/yr, while the soil DCGLs will correspond to a dose of 8.73 mrem/yr (to reflect subtracting 1.27 mrem/yr dose due to groundwater pathways from the 10 mrem/yr limit).

Chapter 5 of the LTP provides the methods used to combine these DCGLs, using the sum-of-fractions to ensure that, when multiple radionuclides are present, the residual dose for each survey unit does not exceed the 10 mrem/yr release criteria.

Concrete remaining onsite, in the form of partial subsurface structures or concrete/asphalt debris, will be in accordance with a MADEP Beneficial Use Determination (BUD) and will contain no distinguishable plant-related radioactivity above background. Although separate from compliance for the MADPH criterion, the Massachusetts Department of Environmental Protection (MADEP) has set forth much more conservative criteria than that contained in the LTP to define "no distinguishable plant-related radioactivity above background" in its BUD for subsurface structures and concrete/asphalt debris. The definition of "background" as it relates to lab analysis sensitivity is:

- Gamma-emitting radionuclides: Environmental lower limit of detection (LLD) for Cs-137 of 0.18 pCi/g and
- Minimum detection limits (MDLs) for hard-to-detect (HTD) radionuclides:
 - H-3 of 5 pCi/g
 - C-14 of 2 pCi/g
 - Sr-90 of 2 pCi/g

It was determined that sampling for the entire suite of HTD radionuclides listed in the LTP was unnecessary to demonstrate compliance with the BUD criteria. This determination was based upon the following: (1) plant related-radionuclides fall into one of two categories: fission products and activation products and (2) for each of two categories, the presence of surrogate radionuclides (i.e., radionuclides found present alongside the original radionuclide but easier to detect) is being investigated (e.g., Sr-90 and Cs-137 for fission products and Co-60 for activation products). Additionally, the groundwater monitoring program investigates the presence of all radionuclides listed in the LTP. To date H-3 is the only plant-related radionuclide detected, and it is groundwater that would be the source of contamination for the subsurface partial structures.

The average levels of Cs-137, H-3, C-14, and Sr-90 within an individual subsurface concrete substructure (or debris pile) will be used for comparison against the individual MDLs outlined above. In addition to the MDLs is the establishment of upper limit (UL) values for the HTD radionuclides to be applied to any concrete "hotspots" in the subsurface structures or debris piles. These ULs are equal to 3 times the minimum detection limits.

Yankee will also demonstrate that all LTP commitments will be met and that the site meets the MADPH limit of 10 mrem/yr TEDE and the NRC limit of 25 mrem/yr TEDE. Table 1 provides the listing of the limits that will be met to demonstrate compliance with the MA DPH requirements. For multiple radionuclides, the individual radionuclide values will be compared to their applicable DCGL, and the sum-of-fractions will be applied to support final status surveys, as described in Chapter 5 of the LTP.

Table 1
Limits for Different Media Types

Radionuclide	Soil DCGL* (pCi/g)	Building Surface DCGL† (dpm/100 cm ²)
H-3	1.3E+02	1.4E+08
C-14	1.9E+00	4.0E+06
Fe-55	1.0E+04	1.6E+07
Co-60	1.4E+00	7.2E+03
Ni-63	2.8E+02	1.5E+07
Sr-90	6.0E-01	5.6E+04
Nb-94	2.5E+00	1.0E+04
Tc-99	4.8E+00	5.6E+06
Ag-108m	2.5E+00	1.0E+04
Sb-125	1.1E+01	4.0E+04
Cs-134	1.7E+00	1.2E+04
Cs-137	3.0E+00	2.5E+04
Eu-152	3.5E+00	1.5E+04
Eu-154	3.3E+00	1.4E+04
Eu-155	1.4E+02	2.6E+05
Pu-238	1.1E+01	2.3E+03
Pu-239/240	1.0E+01	2.0E+03
Pu-241	3.4E+02	1.0E+05
Am-241	1.0E+01	2.0E+03
Cm-243/244	1.1E+01	2.9E+03

* DCGL corresponds to 8.73 mrem/yr.

† DCGL corresponds to 10 mrem/yr.

2.3 Final Status Survey Design and Implementation

The Final Status Survey (FSS) will use the limits provided in Table 1 along with the criteria, methods, and statistical tests provided in Chapter 5 of the LTP. This includes the use of area factors provided in Chapter 6 and the investigation criterion in Chapter 5.

Chapter 5 of the LTP requires that, prior to the use of advance technologies for performing final status surveys, a technical basis document will be prepared that ensures that the technology provides for equivalent results. In this context, advanced technology includes in-situ gamma spectroscopy and spatially correlated data logging instrumentation. The LTP also requires that this basis document be available for review by the NRC prior to implementation. These documents are also available to the MA DPH.

2.4 Groundwater Dose Contributions

The LTP provides a commitment that, at the time of license termination, concentrations of radioactivity in the groundwater concentration will meet the EPA's Maximum Contaminant Levels (MCLs) for drinking water. For tritium, the only confirmed radionuclide present in groundwater, this corresponds to a concentration of 20,000 pCi/L. The LTP provides a dose assessment and conservatively concludes that this concentration equates to 0.77 mrem/yr for a resident farmer's well. In addition, the LTP calculates a 0.5 mrem/yr dose from partial subsurface structures based upon the contamination levels given in the LTP and a groundwater-borne dose pathway, assumed because of their inaccessibility and inability to support crop growth. The LTP allowable contamination levels are very conservative compared to the levels used by the MA DEP to define "no distinguishable plant-related radioactivity above background." Thus, the total dose contribution from groundwater pathways is 1.27 mrem/yr. As groundwater pathway is included in the pathways considered in the resident farmer scenario, the 1.27 mrem/yr will be subtracted from the 10 mrem/yr limit, leaving 8.73 mrem/yr allowable dose from soils. The groundwater pathway is not included in building occupancy scenario, and thus its dose contribution is not required to be subtracted from the 10 mrem/yr limit. This approach is consistent with the LTP.

3.0 Implementation

The following represents a summary of the implementation of the final status survey activities in compliance with the MA DPH requirements.

- The survey area classifications based upon the LTP will be applied.
- The limits to be used in the final status survey are provided in Table 1.
- The FSS activities will be performed in accordance with Chapter 5 of the LTP including the use and review of advanced technologies.

As survey units are completed, a final status survey record will be generated. These records will contain all of the information required to verify that each survey unit has passed the FSS criteria, including classification verification, survey design, survey results, and the applicable statistical tests. Each of these records will represent a data quality assessment to ensure that all of the data quality objectives have been achieved and/or addressed. Once a sufficient compilation of survey records is complete, a final status survey report will be prepared. This FSS report will contain all of the completed FSS records and will provide a detailed description and narrative of the completed FSS activities, quality assurance measures, isolation and control measures, and a summary of the results. These reports will likely represent a logical and possibly contiguous section of the site for which decommissioning and remediation activities are complete. These records and reports will be prepared to meet the NRC requirements and will be available for review by the NRC and MADPH upon completion.

4.0 CONCLUSION

The application of the appropriate limits, as outlined in Table 1, during the Final Status Survey will result in compliance with both NRC and MADPH requirements. Implementation of these criteria will be accomplished through the FSS survey plan development and verified through the data quality review process.