UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO ONSITE DISPOSAL OF CONTAMINATED SOIL

VERMONT YANKEE NUCLEAR POWER CORPORATION

VERMONT YANKEE NUCLEAR POWER STATION

DOCKET NO. 50-271

INTRODUCTION

By letters dated November 18, 1991, and July 10, 1992, the Vermont Yankee Nuclear Power Corporation (the licensee) requested approval pursuant to Section 20.2002 of Title 10 of the Code of Federal Regulations (CFR) for the disposal of licensed material not previously considered in the Vermont Yankee Final Environmental Statement (FES), dated 1972.

The Vermont Yankee request contains: (a) a detailed description of the licensed material to be disposed of, including the physical and chemical properties important to risk evaluation, and the proposed manner and conditions of waste disposal; (b) an analysis and evaluation of pertinent information on the nature of the environment; (c) the nature and location of other potentially affected licensed and unlicensed facilities; and (d) analyses and procedures to ensure that doses are maintained as-low-as is reasonably achievable and within the dose limits in 10 CFR Part 20.

DESCRIPTION OF WASTE

In 1991, a leak was discovered in a chemistry laboratory drain inside the radiation control area (RCA) that allowed discharge from the chemistry laboratory sink to seep directly into the structural fill soil beneath the floor slab. The fill soil is a 15 foot layer of fine-grained sand with some silt and minor gravel. The area is confined on three sides by existing foundations and on the bottom by bedrock. All of the soil volume under the 150-foot length of buried pipe is contaminated; the total volume is about 58,500 cubic feet. The end of the pipe has been capped and the area of excavation has been backfilled with concrete to the original floor line so that the line is inaccessible.

New piping for the sink has been run above the floor to the collection tank. This new piping is accessible over its full length for periodic inspection to preclude a repeat of this event. The licensee has no way of determining how long the drain has been leaking; in order to bound the potential impacts associated with the leakage, the licensee assumed that the drain line had been leaking for 10 years. Samples of soil from grade to bedrock were obtained

from a split-spoon boring through the floor of the chemistry laboratory. Samples were analyzed for chemical and radionuclide distribution and concentration. Estimated amount of the principal radionuclides bound in the contaminated soil are listed in Table 1. The activity remaining after a 20 year decay period are also presented in the table.

Table 1 Radionuclide Activity and Concentration

Nuclide (half-life) (in years)	* Activity µCi	** Activity µCi
H-3 (12.2)	8.0E+04	2.6E+04
Mn-54 (0.85)	5.4E+01	4.9E-06
Fe-55 (2.7)	4.4E+02	2.6E+00
Co-60 (5.27)	4.1E+02	3.0E+01
Cs-134 (2.06)	3.9E+01	4.8E-02
Cs-127 (30.17)	1.4E+02	8.7E+01
Sr-90 (28.6)	3.2E-01	2.0E-01

* Activity after 10 years of weekly "batch" releases
** That activity after a 20 year decay period.

The chemistry laboratory is located in the lower level of the office building at the north end of the turbine building complex. During plant construction, this area was excavated to bedrock, 15 feet below the chemistry laboratory (El. 233 feet). The area under the laboratory was then filled to its current grade and the concrete laboratory floor was poured. It is impractical to remove this contaminated material because it is located underneath building structures.

PROPOSED DISPOSAL METHOD

The licensee proposed to leave the contaminated soil in place. By terminating the release of liquids into the failed drain line, there is no significant driving force to cause any further movement of the activity now in the soil below the chemistry laboratory floor any deeper toward the groundwater level. The natural groundwater surface appears to be below the bedrock surface beneath the chemistry laboratory. The total quantity now present is sufficiently small that it does not present a direct radiation exposure hazard in the chemistry laboratory. To remove the material would, however, require major excavation under the laboratory floor in proximity to the reactor building foundation and other critical structures, and would directly expose workers performing the excavation to the hazard. The direct exposure, as well

as potential airborne exposures to workers performing remediation, outweigh the risk of leaving the contamination in place, and exceed by far the potential risk to a future population from leaving the contaminated soil where it is. There is no practical way for this material to be removed from the plant at this time.

RADIOLOGICAL IMPACTS

The licensee evaluated the following potential exposure pathways to members of the general public from the radionuclides in the contaminated soil: (1) external exposure caused by farming on the contaminated grounds, (2) internal exposure caused by inhaling of resuspended radionuclides, and (3) internal exposure from ingesting groundwater, and water from onsite potable wells.

Table 2 presents the doses calculated by the licensee for the maximum exposed member of the public from the contaminated soil under the floor of the chemistry laboratory. These doses are based on the radionuclide activities in Table 1. The doses were calculated for an inadvertent intruder for the following pathways: ingestion of food from crops raised on contaminated land, ingestion of milk from cows grazing on the contaminated land, and inhalation of suspended material. It is also assumed that the family and animals raised on the land also drink water from the contaminated land and breathe only air affected by the contaminated area.

Table 2 Intruder Exposures

Pathway	Whole Body (mrem)	Organ (mrem)
Drinking water ingestion	2.9E-05	6.3E-05
Irrigation exposure pathway	1.2E-04	4.0E-04
Well water ingestion	3.8E-01	1.9E-01
Direct ground plane	2.7E-01	0.0E-00
Inhalation (resuspension)	1.1E-01	6.5E-01
Leafy vegetable	2.5E-02	2.4E-01
Cow milk	1.6E-01	1.5E-01

The licensee conservatively calculated these values with the assumption that the total exhumation of the 58,500 cubic feet of radioactive material and spreading in a layer equivalent to the plow depth, results in a continuous annual exposure of less than 1 mrem. This is a small fraction of the 300 mrem received annually by members of the general public in the United States and Canada from sources of natural background radiation.

The guidelines used by the NRC staff for onsite disposal of licensed material and the staff evaluation of how each guideline has been satisfied are given in Table 3.

The staff has reviewed the licensee's calculational methods and assumptions and find that they are consistent with NUREG-1101, "Onsite Disposal of Radioactive Waste," Volumes 1 and 2, November 1986 and February 1987, and Regulatory Guide 1.109, "Calculation of Annual Doses to Man From Routine Releases of Reactor Effluent for the Purpose of Evaluating Compliance With 10 CFR Part 50, Appendix I," Revision 1 (October 1977). The staff finds the assessment methodology acceptable.

On this basis, the staff finds the licensee's procedures and amendments acceptable as documented in this safety evaluation. This safety evaluation will be added to the licensee's Offsite Dose Calculation Manual (ODCM). No future modifications are necessary prior to decommissioning of the plant.

The licensee's proposal to dispose of the contaminated soil under the chemistry laboratory (onsite) in a manner described in the Vermont Yankee submittal dated July 10, 1992, is acceptable.

Table 3 Guidelines for Onsite Disposal of Licensed Material

20.2002 GUIDELINE FOR ONSITE DISPOSAL	STAFF'S EVALUATION
The radioactive material should be disposed of in such a manner that it is unlikely that the material would be recycled.	The nature of the disposed material makes it unlikely that it would be recycled to the general public.
Doses to the total body and any body organ of a minimally exposed individual (a member of the general public or a non-occupationally exposed worker) from the probable pathways of exposure to the disposed material should be less than 1 mrem/year.	This guideline is addressed in Table 2.
Doses to the total body and any body organ of an inadvertent intruder from the probable pathways of exposure should be less than 5 mrem/year.	Because the material is insitu, the staff considers the maximally exposed individual scenario to also address the intruder scenario.
Doses to the total body and any body organ of an individual from assumed recycling of the disposed material at the time the disposal site is released from regulatory control from all likely pathways of exposure should be less than 1 mrem.	Even if recycling were to occur after release from regulatory control, the dose to a maximally exposed member of the public is not expected to exceed 1 mrem/year, based on exposure scenarios considered in this analysis.

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