
Final Report

Cumulative Risk Assessment for the Maine Yankee Facility

Prepared for
Maine Yankee

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Table of Contents

Summary	4
1. Introduction	6
2. Background	7
2.1 Radiological Cleanup	7
2.2 Chemical Cleanup.....	8
2.3 Common Cleanup Goals.....	9
2.4 Similarities in Approach	9
2.5 Differences in Approach	10
2.6 Basis for Cumulative Risk Assessment Approach	11
3. Development of Conceptual Model of Exposure Pathways	13
3.1 Description of the Exposure Setting.....	13
3.1.1 Exposure Setting in Soil – RFI	13
3.1.2 Exposure Setting in Soil – Final Status Survey	15
3.1.3 Evaluation of Combined Exposure Units in Soil for Radionuclides and Chemicals	16
3.1.4 Exposure Setting for Chemical Constituents in Groundwater – RFI	16
3.1.5 Exposure Setting in Groundwater – Radionuclide Groundwater Monitoring Program.....	17
3.1.6 Evaluation of Combined Exposure Units in Groundwater for Radionuclides and Chemicals	18
3.1.7 Exposure Setting for Chemical Constituents in Off-site Sediments – RFI.....	18
3.1.8 Exposure Setting in Off-site Sediments – Marine Sampling Study	19
3.2 Identification of Potentially Exposed Individuals and Exposure Pathways ...	21
3.2.1 On-Site Worker Scenario.....	21
3.2.2 On-Site – Residential Scenario	21
3.2.3 Off-site Scenario: User of Shoreline Area	22
3.2.4 Construction Worker	22
3.3 Independent Spent Fuel Storage Installation (ISFSI)	22
4. Identification of Constituents of Potential Concern	23
4.1 COPC Identification - Chemicals.....	23
4.2 COPC Identification – Radionuclides	24
5. Exposure Assessment	27
5.1 Identification of Potential Exposure Pathways.....	27
5.2 Estimation of Exposure Point Concentrations	28
5.2.1 Selection of Exposure Units.....	28
5.2.2 Calculation of Exposure Point Concentrations.....	28
5.3 Quantification of Contaminant Intake	28
5.4 Calculation of Radiation Dose.....	30
6. Cumulative Risk Evaluation.....	31
6.1 Evaluation of Cancer Risks – Chemicals.....	31

6.2 Evaluation of Cancer Risks – Radionuclides.....	31
6.2.1 Development of Risk Coefficients	31
6.2.2 Use of Risk Coefficients in the Cumulative Risk Assessment	32
6.2.3 Development of Radionuclide Cancer Slope Factors.....	32
6.3 Risk Characterization	33
6.3.1 Cumulative Risks – Soils in On-site Areas	33
6.3.2 Cumulative Risks – Groundwater in On-site Areas	36
6.3.3 Cumulative Risks – Potential Onsite Residents.....	37
6.3.4 Cumulative Risks - Offsite Areas.....	37
6.3.5 Cumulative Risk from the ISFSI.....	38
6.3.6 Backland Area.....	38
7. Conclusions.....	40
8. References	41

Tables

- 3-1 Exposure Unit Summary
- 4-1 Summary of Carcinogenic Chemicals of Potential Concern Present in Contaminated Media
- 4-2 Summary of Constituents of Potential Concern in Soil
- 4-3 Summary of Constituents of Potential Concern in Groundwater
- 4-4 Summary of Constituents of Potential Concern in Sediments
- 4-5 Summary of Constituents of Potential Concern in Shellfish Tissue
- 4-6 Summary of Nuclides Potentially Present in Contaminated Media
- 4-7 Annual Dose Contributions from Contaminated Material
- 4-8 Contributions to Annual Dose from Surface Soil
- 4-9 Statistics and concentration of Radionuclides - Soil
- 4-10 Statistics and Concentrations of Radionuclides - Groundwater
- 5-1 Preliminary List of Potentially Complete Exposure Pathways
- 5-2 Exposure Factors Used in Calculation of Contaminant Intakes
- 5-3 Assumptions Used to Calculate Produce Ingestion in the HHRA
- 5-4 Comparison of Produce Ingestion Parameters Used to Evaluate Radionuclide and Chemical Risks in Soil
- 6-1 Cumulative Risk Assessment Summary - Soils
- 6-2 Cumulative Risk Assessment Summary - Groundwater
- 6-3 Summary of Risks to Hypothetical Future Residents

Figures

- 3-1 Survey Unit Designation Overview
- 3-2 Survey Unit Designation Table
- 3-3 Survey Unit Designation Detail, SU01 - SU25
- 3-4 Survey Unit Designation Detail, SU26 - SU37
- 3-5 Survey Unit Designation Detail, SU38 - SU48
- 3-6 Survey Unit Designation Detail, SU49 - SU52

Appendixes

- A - Meeting Notes - Cumulative Risk Assessment Approach
- B - Cumulative Risk Assessment for the Backlands
- C - The Independent Spent Fuel Storage Installation and Cumulative Risk Assessment
- D - Comparison of Produce Ingestion Risks from Radionuclides with Different Parameters
- E - Cumulative Risk Assessment Calculations - Soil
- F - Cumulative Risk Assessment Calculations - Groundwater

Summary

This document presents an assessment of the end-state cumulative risks for chemical and radionuclide constituents at the Maine Yankee site on Bailey Point, Wiscasset, Maine. Cumulative risks have been calculated based on results from dose assessments developed using the methodology presented in the License Termination Plan (LTP) for radionuclides and risk estimates for chemical contaminants, calculated as part of the Resource Conservation and Recovery Act (RCRA) closure activities. Key elements in the cumulative risk assessment framework include:

- A process to evaluate plant-derived radionuclides (as identified in the LTP, MYAPC, 2005a) that are above background levels in order to select radionuclides as contaminants of potential concern (COPCs) for the cumulative risk assessment. A process for selecting chemical contaminants as COPCs has already been documented for the RCRA program (MYAPC, 2004).
- Exposure scenarios for developing reasonable estimates of potential exposures to chemical and radionuclide constituents, considering likely future land use at the site. Exposure factors, based on U.S. Environmental Protection Agency (EPA) and U.S. Nuclear Regulatory Commission (NRC) guidance, were used in estimating exposures and doses from chemical and radionuclide constituents.
- A process to relate radionuclide dose estimates, calculated in accordance with methods approved by NRC, as corresponding excess lifetime cancer risk estimates. With this process, dose estimates were converted to excess lifetime cancer risks, for comparison with risk estimates developed for chemical constituents.

This cumulative risk assessment report was developed to satisfy the requirements in State Public Law, Chapter 739 38 MRSA Section 1455, "Nuclear Facility Decommissioning Cleanup". This law requires that the cumulative risk posed by radiological and chemical contaminants shall be evaluated at a facility undergoing decommissioning.

The results of the cumulative risk assessment were as follows:

- In general, cumulative risks were driven by the chemical constituents in soil. On average, radionuclide risks for the residential scenario were approximately 1 percent of the cumulative risk; the large contribution to chemical-related risk in this scenario is via the plant ingestion pathway. Radionuclides in soil did not result in a significant cumulative risk across the site.
- In general, cumulative risks were also driven by the chemical constituents in groundwater. In general, radionuclide risks for the residential drinking water scenario were less than 1 percent of the cumulative risk. In addition, Maine Yankee intends to place an institutional control on all of Bailey Point, limiting future land use to commercial/industrial activities. This control also would prohibit groundwater use on Bailey Point by preventing the installation of water supply wells within the area of

contaminated groundwater. These institutional controls would be implemented through a restrictive covenant.

- Risks from ingestion of shellfish caught near Maine Yankee (in offsite areas) and from reference areas well away from the facility were similar, both for chemical contaminants and radionuclides. Therefore, there are no offsite cumulative risks from shellfish consumption attributable to plant derived radionuclides or chemical contaminants.
- As requested by the State of Maine, the cumulative risk assessment used the smallest units of analysis feasible in assessing cumulative risks to facilitate the identification of areas where institutional controls may be needed. Detailed appendixes and figures depicting the areas where cumulative risks were assessed have been included in this report to support the identification of areas where institutional controls may be needed.

1. Introduction

This document describes the assessment of the cumulative human health risks associated with potential exposure to chemical and plant-derived radionuclide constituents detected in environmental media after decommissioning of the Maine Yankee facility. It responds to requirements specified in legislation passed by the State of Maine requiring that the cumulative risk posed by radiological and chemical constituents be evaluated at a facility undergoing decommissioning (State Public Law, Chapter 739 38 MRSA Section 1455, “Nuclear Facility Decommissioning Cleanup”).

Potential health impacts associated with radionuclides and chemical constituents were addressed by two separate processes for the Maine Yankee facility. The dose from residual radioactivity remaining following decommissioning was calculated in accordance with procedures and guidelines defined by the U.S. Nuclear Regulatory Commission (NRC). The general process is described in the License Termination Plan (LTP) prepared by Maine Yankee (MYAPC, 2005a). The health risks from residual chemical constituents have been addressed as a part of site closure under the Resource Conservation and Recovery Act (RCRA). RCRA closure activities use risk assessment guidance published by the U.S. Environmental Protection Agency (EPA) to calculate health risks associated with environmental media affected by chemical constituents.

The cumulative risk assessment was developed as a separate process from either the LTP or RCRA closure. It harmonizes the results from these distinct processes in order to develop cumulative risk estimates for plant-derived radionuclides and chemical constituents. Individually, the LTP and the RCRA closure activities achieved specified levels that are protective of human health, respectively for plant-derived radionuclides and chemical contaminants. However, the cumulative risk assessment focuses on those locations where there may be overlap in the occurrence of chemical and radionuclide constituents. The overall objective of the cumulative risk assessment is to demonstrate and document cumulative risk levels under plant end-state conditions (following RCRA closure and license termination activities). In other words, the cumulative risk assessment presents an evaluation of site risks remaining after decommissioning activities.

This cumulative risk assessment report was prepared according to a framework developed in consultation with Maine Yankee, the Maine Department of Environmental Protection (MDEP) and EPA Region 1 (MYAPC, 2002). The overall approach was agreed to in a meeting on July 10, 2002 between Maine Yankee, MDEP, the Maine Bureau of Health (MBOH), and EPA Region 1. The notes from that meeting are presented in Appendix A. Refinements to that approach were discussed between Maine Yankee, MDEP, and MBOH on August 1, 2006. The notes from the August 1st meeting are also presented in Appendix A.

2. Background

Maine Yankee is completing the decommissioning of the state's only commercial nuclear power plant, a process that will result in the cleanup of the site to protectiveness standards established by NRC, EPA, and the State of Maine. The remediation and restoration of the site involves the characterization and, where necessary, removal of potential chemical and radiological hazards. The regulations that establish the chemical and radiological cleanup levels are stringent and comprehensive, requiring the demonstration of standards that are protective of human health and the environment, and consistent with the future land use of the site and its environs.

The cumulative risk assessment for plant-derived radionuclides and chemical contaminants must harmonize the results from NRC's decommissioning process with EPA's RCRA closure process to achieve the overall objective of documenting cumulative risk levels under plant end-state conditions. The following sections describe separately the basis for the NRC process as it was applied to the Maine Yankee facility, and the EPA RCRA closure process. It also presents key similarities and differences in those two processes, and the overall approach for harmonization. That approach was developed in consultation with the State of Maine and EPA Region I, as documented in the cumulative risk assessment framework document (MYAPC, 2002).

2.1 Radiological Cleanup

NRC is the federal agency responsible for setting radiological protection standards for nuclear power plants. The standards set by NRC include limits on radiological doses to both plant workers and members of the public. The dose limits for members of the public are based on the recommendations of the International Commission on Radiation Protection (ICRP) and the National Commission on Radiation Protection (NCRP). A dose limit of 100 millirems (mrem) per year is established for members of the public from man-made sources of radiation, and is designed to limit exposures to reasonable levels of risk compared to other sources. This limit does not include exposure from naturally occurring background radiation, which can commonly contribute 250 mrem per year or more to individual exposure.

NRC has established a dose limit for unrestricted release of a site undergoing decommissioning at 25 mrem per year for the average member of the critical group. This limit was established based on the conclusion that, although the limit for doses to members of the public is 100 mrem per year from all man-made sources, the amount of dose that an individual could potentially receive from a single source should be reduced to a fraction of the 100 mrem limit. This dose to an individual must be evaluated in a very specific manner in accordance with NRC guidance.

The State of Maine has also established protective standards for nuclear power plant decommissioning. Through legislative action, the State has set a dose limit of 10 mrem, not more than 4 mrem of which may be received from drinking contaminated groundwater. The

legislation requires demonstration of compliance with this standard using actual measurements and the analytic methodology approved by NRC and supplemented by modeling the effects of engineering controls designed to reduce exposure. Maine Yankee has committed to meeting the State of Maine cleanup standard.

The establishment in advance of a protectiveness standard in the form of a dose limit, followed by whatever remediation activities are required to meet the standard, is referred to as a “top down” approach. The dose limit is established to ensure that adverse human health effects do not exceed unacceptable levels. Technology, cost, and human factors are considered in applying all available means to reduce the dose as far below the limit as possible, but compliance with the limit is mandatory and non-negotiable.

There is no risk standard applicable to a radiological cleanup of an NRC-licensed facility. Protectiveness is demonstrated by using very conservative assumptions in evaluating compliance with the public dose standard. The State of Maine has included a requirement in its nuclear facility decommissioning legislation that the cumulative risk posed by radiological and chemical contaminants remaining at the site be evaluated.

This dose-based approach for establishing protectiveness of radionuclide cleanup activities is documented in Section 6 of the LTP (MYAPC, 2005a).

2.2 Chemical Cleanup

EPA is the federal agency responsible for setting chemical cleanup standards for industrial facilities. Applicable chemical cleanup standards depend on the history and condition of a particular site. At the Maine Yankee site, chemical characterization and remediation activities are being accomplished to standards established under RCRA. RCRA standards are implemented through federal and state regulations. MDEP is the lead oversight agency for the Maine Yankee RCRA cleanup activities, and EPA is providing technical support to the state. Federal and state protectiveness standards for chemical constituents are based on avoiding unacceptable ecological and human health related hazards and risks.

Although chemical-specific concentration guidelines and standards have been established for hundreds of chemical constituents, ultimate determination of a successful cleanup is typically evaluated to an acceptable risk range. This risk is evaluated as the lifetime probability of the incidence of cancer in an exposed individual.

Risk assessments involving chemical constituents typically involve setting an acceptable risk level up front and applying technology to control exposure or remove the constituent in order to achieve the risk goal. If the risk goal cannot be achieved based on feasibility, cost, unique site-specific circumstances, or other factors, a risk level that differs from the upfront goal may be deemed acceptable. This is referred to as a “bottom up” approach to risk management.

A baseline risk assessment presented as part of the RCRA Facility Investigation (RFI) report prepared for the Maine Yankee facility (MYAPC, 2004) documents the approach for assessing risks associated with the chemical contaminants.

2.3 Common Cleanup Goals

Although the standards applicable to chemical and radiological cleanups may differ in their approach and application, the overall goals are exactly the same:

- Reduce exposures to hazardous materials in order to protect human health and the environment
- Establish and maintain public confidence that the cleanup has been accomplished in a manner that protects human health and the environment, now and in the future
- Use a sound, science-based and technically defensible approach to modeling potential exposures and health effects
- Demonstrate compliance with applicable standards

2.4 Similarities in Approach

Chemical and radiological risk assessment protocols have fundamental differences in their approach to evaluating health effects, yet there are many notable similarities that can form the basis for harmonization. Similarities in inputs, assessment processes, and outcomes are examined below.

Both chemical and radiological risk assessment methods use, out of necessity, extrapolation of probable health effects to extremely low doses of contaminants. This extrapolation is necessary because of the fundamental underlying assumption that any exposure to a contaminant known to cause adverse health effects in relatively large doses must result in the probability of some adverse effect, even in very small doses. This assumption is not without its detractors. Radiological hazards are generally assumed to have a linear dose/response relationship according to the so-called “linear, non-threshold” theory. Chemical dose/response relationships are not always assumed to be linear, and numerous mathematical models are used to calculate the response to small concentrations of chemicals.

For the purposes of risk characterization, both chemical and radiological assessment procedures are concerned with cancer in humans. Although chemical risk assessments can also include consideration of non-cancer and ecological risk, the focus of the harmonization effort is on cancer risk. The doses of radiation large enough to cause acute effects are not possible under the closure standards promulgated by regulatory agencies, and, although genetic and hereditary effects are a concern, cancer risk is the primary health effect under consideration. The ecological risk associated with exposure to radiation has long been assumed to be bounded adequately by the human health risk.

Large uncertainties are associated with both chemical and radiological risk assessments. The extrapolation of health effects from high to low doses introduces considerable uncertainty, as does the use of animal studies to infer human effects. EPA has recognized that, at the level of environmental exposure to radionuclides being considered, it is impossible to distinguish from natural disease incidences, even using large epidemiological studies and sophisticated statistical analyses. Risk models must consider many factors, such as human

behavior, biological processes, age distributions, and mortality rates, each of which have relative degrees of uncertainty. Combine all of the above with the uncertainty associated with the chemical and radiological characterization data, and the total uncertainty of an assessment can easily be an order of magnitude.

Both chemical and radiological risk assessments include consideration of societal concerns and cost vs. benefit. Cost vs. benefit is considered when designing remedial strategies based on chemical risk assessment results. Although perhaps less directly, cost vs. benefit is considered in As Low As Reasonably Achievable (ALARA) analyses required by NRC regulations in developing radiological remediation levels.

The characterization data that provide the starting point for exposure assessment are subject to extensive quality assurance requirements in both the chemical and radiological world. The Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), developed jointly by NRC, EPA, the Department of Energy, and the Department of Defense, provides the basis for planning, implementing and evaluating radiological surveys conducted to demonstrate compliance with dose- or risk-based regulation. A Quality Assurance Program Plan (QAPP), prepared in accordance with EPA guidelines and approved by the State of Maine, outlines the quality assurance measures applied to chemical characterization data to assure that results obtained are of the type and quality needed to support risk assessment.

2.5 Differences in Approach

Radiological and chemical risk assessment methodology are different in ways that must be understood and ultimately reconciled or accepted in order to truly harmonize the two approaches. Some differences exist simply because of physical dissimilarities between chemical and radiological hazards, while other differences are the product of divergent regulatory approaches.

Chemical risk determinations use baseline scenarios to evaluate the potential risk to human health from an uncontrolled site with no remediation. Remedial strategies and institutional controls are then applied to reduce risk, as necessary, to acceptable levels. In contrast, acceptable risk levels are built into the regulations governing radiological closure criteria. In the radiological “top down” approach, a dose-based closure standard is the starting point for remedial strategies, with the ultimate cleanup being accomplished to meet or exceed the standard in accordance with ALARA principles.

Background concentrations of potentially hazardous chemicals are typically not excluded from the initial risk determination, while background concentrations of radioactive materials are specifically excluded from closure criteria. Background levels of radioactive material exist in the environment because of naturally occurring isotopes, in addition to low concentrations of material remaining worldwide from atmospheric testing of nuclear weapons. NRC site closure criteria specifically apply only to “residual radioactivity that is distinguishable from background radiation.”(NRC, 2000)

The basis for identifying human health effects from chemicals and radionuclides differs greatly. The health effects of radiological exposures are based on vast amounts of human epidemiological data gathered over the years, associated with atomic bomb blast survivors and various industrial and medical uses of radioactive materials. Chemical health effects are

largely based on animal studies that are used to predict potential human health effects. Animal studies, although useful in advancing an understanding of dose/response relationships, are considerably more uncertain than epidemiological studies. It is therefore generally recognized that more certainty is associated with radiological risk estimates than with chemical risk estimates.

The NRC methodology used to calculate a theoretical dose to individuals from exposure to radioactive materials is extremely conservative. Dose calculations performed in conformance with site closure criteria are required to assume residence times and behaviors (which may bring individuals into contact with radionuclides) that are bounding, but not particularly reasonable. NRC unrestricted release criteria do not allow the elimination of pathways through institutional controls. Chemical exposure assessments, on the other hand, use reasonable assumptions to calculate the risk to a maximally exposed individual. The elimination of pathways through institutional controls is integral to remedy selection at hazardous chemical sites.

There are fundamental differences in the physical characteristics of radiological hazards when compared to chemical hazards, primarily because radioactive material releases energy through the radioactive decay process. For example, the release of energy through radioactive decay results in "direct" exposure to individuals who do not necessarily come into direct contact with the material. This direct exposure pathway has no equivalent in chemical exposure assessment.

2.6 Basis for Cumulative Risk Assessment Approach

Key issues regarding the approach to the cumulative risk assessment were discussed in a meeting held July 10, 2002, involving Maine Yankee, MDEP, MBOH, and EPA - New England (Region I). The following agreements were obtained at this meeting regarding the approach for conducting the cumulative risk assessment:

- Maine Yankee would perform the cumulative risk assessment to estimate risks associated with the site after remediation for radiological and chemical contaminants is complete.
- The cumulative risk assessment would evaluate estimates of risks under residential future use assumptions for Bailey Point in addition to industrial/commercial future use assumptions, in order to evaluate where institutional controls (e.g., deed or zoning restrictions) may be needed. The stakeholders agreed that a reasonable goal is to limit the size of site areas that warrant such controls as much as possible.
- The stakeholders confirmed that cleanup to the 10/4 mrem/year standard imposed by the legislature is the radiological cleanup standard to which Maine Yankee will ultimately be held. The stakeholders acknowledge that certain limited areas of the site (possibly as small as 1 acre) may meet the 10/4 dose standard yet still pose a cumulative increased lifetime cancer risk greater than 10^{-5} (the risk threshold used by MDEP to make cleanup decisions for chemical contaminants). Maine Yankee is agreeable to evaluating the use of institutional controls for these areas once the actual risks are known.

- The stakeholders agreed that the cumulative risk assessment can be used to meet the legislative mandate. The cumulative risk assessment can additionally be used as a tool for evaluating the land area where institutional controls such as deed or zoning restrictions are warranted, by comparing the results to the same guideline routinely applied by MDEP at hazardous waste sites.

A copy of the minutes from this meeting, prepared by MDEP, was presented in the cumulative risk assessment framework document (MYAPC, 2002). These meeting minutes also are reproduced in Appendix A in this document.

In August 2006, Maine Yankee, MDEP and MBOH came to these additional agreements on the content of the cumulative risk assessment:

- It is intended to provide a realistic estimate of total risks after cleanup.
- It is intended to allow policy makers to understand how to manage the site in the future.
- While there is an acknowledgement that Maine Yankee is different from other sites in Maine (principally because of the presence of the Independent Spent Fuel Storage Installation [ISFSI]), the way of addressing institutional controls needs to be consistent with other sites. If institutional controls are risk-based, what is the footprint where they are required? Is it possible to analyze risks at the site to make the footprint requiring institutional controls as small as feasible?
- The cumulative risk assessment is not meant to drive remediation but to determine where combined risk exceeds 10^{-5} and where it doesn't (for purposes of defining where the institutional controls need to be applied)

In structuring the cumulative risk assessment report, the objectives are to provide a clear and transparent presentation of the data, define cumulative risk for the site according to regulatory requirements, define the smallest area possible for institutional controls, and provide a free-standing or standalone report with a minimum of reference to information in other documents (within reason). Specific resolutions regarding content to be incorporated into the cumulative risk assessment are discussed in the meeting notes from the August 2006 meeting, which are included in this report in Appendix A.

3. Development of Conceptual Model of Exposure Pathways

The cumulative risk assessment document will present a conceptual model of exposure pathways. The conceptual model will be used to organize site data according to contaminant-source characteristics, migration pathways, affected media, and contaminant properties. It will use existing site information, site characterization, and final status survey data to provide an understanding of the exposure pathways to human populations from both chemical contaminants and radionuclides. The following subsections describe the elements of the conceptual model and the kinds of information to be presented in each element.

3.1 Description of the Exposure Setting

An initial understanding of site conditions has been described in the Bailey Point RFI report (MYAPC, 2004) and the LTP (MYAPC, 2005a). The Maine Yankee site consists of 820 acres; however, most of the site disturbance has taken place on the Bailey Point peninsula south of Old Ferry Road and east of Bailey Cove.

Both the RFI report and the LTP described the site as divided into specific areas for investigation and remediation. The results from site characterization performed as described in the RFI and radiological sampling from the final status survey were evaluated to identify areas where plant-derived radionuclide and chemical constituents may be collocated and/or where there may be significant exposure pathways from plant-derived radionuclides, chemical constituents, or both radionuclide and chemical contaminants.

3.1.1 Exposure Setting in Soil – RFI

The RFI focused on areas of the facility known or suspected to be contaminated by releases or spills associated with operation of the facility and used samples of site media (soil, biota, groundwater, surface water, and sediment) from those suspected release/spill areas to assess site risk to human health and the environment. During its period of operation, minor spills and releases of hazardous substances (primarily petroleum), as well as a few significant releases, had occurred at the Maine Yankee facility. The approach used to partition the facility site into study areas for purposes of the RFI is discussed in the QAPP (MYAPC, 2001). The study areas pertinent to the cumulative risk assessment are:

- Non-industrial areas north of Old Ferry Road and west of Bailey Cove, including the Eaton Farm area, also known as the Backlands Area (Study Areas 1 and 2)
- The industrial areas of Bailey Point South of Old Ferry Road (Study Areas 3, 4, 5, and 6)

The Backlands Area is addressed separately in the cumulative risk assessment in Appendix B. Brief descriptions are presented below of the study areas in the industrial area, and the potential releases that were investigated in those areas.

Study Area 3 – Foxbird Island: Foxbird Island is an island off the southern tip of Bailey Point. It is connected to the mainland by the dikes forming the outer walls of the forebay structure. Buried diffuser piping traversing Foxbird Island was used to carry circulating and service water and liquid effluents from the forebay to a diffuser system south of Foxbird Island. The island had otherwise remained undisturbed with the exception of two topsoil storage piles.

Study Area 4 – ISFSI: This is the area designated for the used nuclear fuel storage, known as the ISFSI, with its surrounding berm, support building, and parking lot. Formerly located in the area was the contractor parking area, the spare generator storage building, and a stockade-fenced storage area. The former spare generator storage building was the site of a kerosene spill from a leaking fuel line associated with a heating unit.

Study Area 5 – Plant Area (Industrial Area): Study Area 5 included most of Bailey Point peninsula south of Old Ferry Road, with the exception of Study Area 4 as described above. It includes most of the industrial facility and supporting administrative offices and warehouses.

Study Area 6 – Offsite Areas: These comprise the intertidal and subtidal zones around the plant area, Study Area 5. It is the area into which the storm drain system drains. It represents tidal areas that are outside the footprint of the area covered by the facility’s license.

Quantitative characterization of health risks associated with chemicals detected at the Maine Yankee facility was conducted as part of the RFI in several areas within the Industrial Area (Study Area 5). Potential receptors and exposure scenarios were based on current and future site use. In developing the human health risk assessment (HHRA), future land use at the site was assumed to be industrial/commercial, with deed restrictions being implemented to limit future development of Bailey Point to industrial/commercial land use. Potential receptors to residual soil and groundwater contamination included future onsite workers and construction workers. Because land use restrictions will limit the development of Bailey Point, Maine Yankee initially did not include residents as potential receptors in the HHRA. However, at the request of MDEP and MBOH, residential exposure to soil and groundwater were evaluated in the HHRA. Maine Yankee considers the residential scenario to be an overly conservative evaluation of future potential exposure and does not propose making risk management decisions based on this assumed future land use. The following exposure areas were evaluated in the Plant Area:

- 115 kV switchyard
- Personnel buildings and parking lot
- Plant area (Industrial Area)
- Warehouse 2/3
- 345 kV transmission line area
- Bailey farmhouse
- ISFSI

Each of these site areas are described below in further detail.

115 kV Switchyard. The a 0.5-acre switchyard area is west of the former Restricted Area and south of Warehouse 2/3. It consists of the 115kV switchyard and a construction transformer.

Personnel Buildings and Parking Lot. The personnel buildings and parking lot area comprises 21.6 contiguous acres north of the industrial fenced area, running east to west through the center of Bailey Point. It contains the fire pond, parking lots, and three personnel buildings (the former staff building, administration building, and former information center).

Plant Area. The Plant, or Industrial, Area, is the 19.5-acre former industrial portion of the plant. It encompasses the area within the industrial fence, which includes the containment building, primary auxiliary building, fuel building, service building, turbine hall, wart building, circulating water pump house and the sewage treatment plant.

Warehouse 2/3 Area. The Warehouse 2/3 area covers 2.9 acres on the southwest side of Bailey Point and was used to receive and store chemicals for plant operations.

345 kV Transmission Line Area. The transmission line area encompasses 45.9 acres in the northern portion of Bailey Point. It includes the area west of the railroad tracks and north of the 345 kV switchyard to Old Ferry Road. The 345 kV switchyard, silt spreading area, ball field and pre-op cleaning basin are located within this area. During plant construction, much of the study areas received several deposits of dredged fill material and land-clearing debris. In addition, a portion of the area was used for silt spreading during plant operation.

Bailey Farmhouse Area. The 8.4-acre Bailey Farmhouse area includes a septic system/leach field (west of the farmhouse), a gray water leach field (east of the farmhouse), and a fuel oil tank in farmhouse basement.

ISFSI. The ISFSI is a 9.5-acre bermed area making up the dry spent fuel storage facility.

In the offsite areas (Study Area 6), other potential receptors include commercial and recreational shellfish harvesters, worm diggers, and other recreational users who may be exposed to residual sediment and shellfish tissue contamination. As discussed previously, these areas were outside the footprint of the area covered by the facility's license, and therefore were not addressed as part of the Final Status Survey (described below). However, potential exposures to radionuclides were evaluated in the offsite areas as part of the marine sampling study (MYAPC, 2005c).

3.1.2 Exposure Setting in Soil – Final Status Survey

The Final Status Survey (FSS) Plan (see Section 5 of the LTP) describes the final survey process used to demonstrate that the Maine Yankee facility and site comply with radiological criteria for unrestricted use (NRC's annual dose limit of 25 mrem plus ALARA and the enhanced state cleanup levels of 10 mrem/year or less for all pathways and 4 mrem/year or less for groundwater drinking sources).

The FSS included remaining structures, land, and plant systems that were identified as contaminated or potentially contaminated as a result of licensed activities. Most of the survey effort was required in the basements of the containment building, fuel building, primary auxiliary building, spray building and the surrounding yard areas. An FSS of the ISFSI location (land area) was initiated prior to construction of the concrete base.

The survey design process established the methods and performance criteria used to conduct the survey. Survey unit size was based on the assumptions in the dose assessment models in accordance with the guidance provided in NUREG-1727 (NRC, 2000).

A characterization of the radiological status and history of the site was used to classify the structures and open land area following guidance in Appendix E of NUREG-1727 and Section 4.4 of NUREG 1575. According to these guidance documents, the licensee first classifies site areas as impacted or nonimpacted. Impacted areas are areas that may have residual radioactivity from the licensed activities. Nonimpacted areas are areas without residual radioactivity from licensed activities. Impacted areas are identified by combining knowledge of past site operations with site characterization surveys. In the FSS, radiation surveys do not need to be conducted in nonimpacted areas. The licensee classifies impacted areas into one of the three classes, depending on the level of residual radioactivity present.

Survey units were areas that were considered to have similar characteristics and contamination levels. Survey units were assigned only one classification. The site and facility were surveyed, evaluated, and released on a survey unit basis.

3.1.3 Evaluation of Combined Exposure Units in Soil for Radionuclides and Chemicals

Cumulative risks were evaluated where the survey units resided within the exposure areas developed for the HHRA. Many of the survey units are approximately a half-acre in size, so several of them fit in each of the HHRA exposure areas. These smaller units of analysis were used in assessing cumulative risks, to facilitate the identification of areas where institutional controls may be needed. In other words, the cumulative risk assessment tabulated chemical and radiological data using the smallest possible comparable units of exposure.

The combination of the HHRA exposure areas and the FSS survey units resulted in eight Exposure Units, which represent the locations in soils where cumulative risks might be present. These Exposure Units are described in Table 3-1. They are also depicted in Figures 3-1 through 3-6.

The uncertainties in combining exposure areas (HHRA) and survey units (FSS) lie in the differences in the sampling approaches between the RFI and the FSS. The RFI involved a more judgmental and focused sampling approach, with samples clustered around areas where potential releases had occurred. The FSS (conducted in accordance with the LTP) was more statistically based, designed to characterize average concentrations within specified areas. For calculating cumulative risks, the RFI sampling data were interpreted conservatively, applying the average concentration across the exposure area to portions of the facility with no history of waste management or releases (and therefore, no sample coverage). When combining these results with the radionuclide risks estimated from FSS data, the outcome is that the FSS data better show the variability in risks across portions of the site. In other words, there are numerous survey units where the chemical risk estimate is the same value; the same risk estimate has been applied to multiple survey units.

3.1.4 Exposure Setting for Chemical Constituents in Groundwater – RFI

The RFI characterization of groundwater beneath the Bailey Point area has identified several areas of contamination related to some aspect of plant construction or operational activities.

Most of the groundwater contamination in the Bailey Point area includes petroleum hydrocarbons (DRO), some volatile organic compounds, and metals (sodium, manganese, and iron) (MYAPC, 2005b). The principal findings from the RFI with respect to groundwater were:

- DRO, aluminum, arsenic, molybdenum, manganese, sodium, and dieldrin in groundwater in several wells located throughout the Restricted Area/Industrial Area and the northern portion of Bailey Point, including ISFSI and the pre-operation cleaning basin
- DRO, boron, iron, manganese, molybdenum, and sodium in groundwater north of ISFSI and under the 345 kV transmission line area within the dredge spoil disposal area
- 1,1,1-trichloroethane and related chlorinated daughter products, manganese, and sodium in groundwater east and south of Warehouse 2/3
- Benzene, toluene, xylene and ethylbenzene (BTEX) compounds, vinyl chloride, aluminum, arsenic, iron, manganese, and molybdenum in groundwater beneath the west side of Warehouse 2/3

The constituents in groundwater identified as carcinogens represent those that would be evaluated in the cumulative risk assessment. These constituents are: arsenic, dieldrin, heptachlor, bis(2-ethylhexyl)phthalate, 1,2-dichloroethane, benzene, bromodichloromethane, trichloroethene, vinyl chloride. Cancer risks associated with these constituents in groundwater, based on central tendency exposure assumptions, were 5.1×10^{-5} . This estimated risk was assumed to represent the typical risk associated with groundwater use throughout the Bailey Point area, for purposes of estimating cumulative risks.

According to the Corrective Measures Study (CMS) (MYAPC, 2005b), the public water supply has been used at the Maine Yankee facility since 1995 for potable purposes. In addition, the groundwater alternatives evaluated as part of the CMS all include institutional controls that will place a restrictive covenant on the use of site groundwater for as a drinking water source.

3.1.5 Exposure Setting in Groundwater – Radionuclide Groundwater Monitoring Program

In June 2004, toward the end of radiological decommissioning of the Maine Yankee site, an agreement was reached between Maine Yankee, MDEP, and MBOH to conduct a 5-year radiological groundwater monitoring plan. This agreement called for wells to be sampled three times a year in each of 5 ensuing years, for a total of 15 sampling events, with all samples analyzed for gamma-emitting radionuclides and tritium in accordance with a table attached to the agreement. These radionuclides included:

H-3	Mn-54	Co-57	Co-60	Fe-59	Zn-65	Nb-94	Zr-95
Ag-110m	Sb-125	Cs-134	Cs-137	Ce-141	Ce144	Eu-152	Eu-154

A specified number of hard-to-detect analyses are called for in the agreement, including:

C-14	Fe-55	Ni-59	Ni-63	Sr-89	Sr-90	Tc-99	I-129
Pu-238	Pu-239	Pu-240	Pu-241	Am-241	Cm-242	Cm-243	Cm-244

In implementing this agreement, Maine Yankee, MDEP, and MBOH decided on 16 wells for sampling. These wells are all located in Study Area 5, the Industrial (Plant) Area. Three of the 15 sampling periods for these wells have been completed as of August 2006.

The calculation of dose for each positively detected nuclide measured above background is based on the dose conversion factors presented in Federal Guidance Report 11 (FGR-11; EPA, 1988) and dose assessment parameters (drinking water consumption rate: 478 liters/year) in the LTP for each well, and the resultant dose is compared to a threshold of 2 mrem/year. The results of this sampling program have been evaluated for cumulative risk for the purpose of this study. The dose calculated above was converted to risk using a factor of 8×10^{-7} risk/mrem. A separate calculation was also performed using the same drinking water consumption rate parameter in the LTP and using the risk conversion factors found in Federal Guidance Report 13 (FGR-13, EPA, 1999).

3.1.6 Evaluation of Combined Exposure Units in Groundwater for Radionuclides and Chemicals

As described in Section 3.1.4, groundwater monitoring for chemical contaminants during the RFI addressed the entire former industrial area across Bailey Point. The radiological groundwater monitoring wells cover a smaller footprint, including survey units located near the former containment building (SU06, SU09, SU04, SU07, SU15, and SU11). The risks from the chemical concentrations potentially represent hypothetical residential groundwater use in any location across Bailey Point.

3.1.7 Exposure Setting for Chemical Constituents in Off-site Sediments – RFI

Sediment samples from the intertidal and subtidal zones around the Bailey Point area where the majority of industrial area stormwater discharges occurred, as well as a gully in the northern reach of Bailey Cove that received runoff from the construction debris/silt-spreading area north of the 345 kV switchyard, were characterized as part of the Bailey Point RFI.

The constituents detected in marine sediment within Bailey Point were metals such as arsenic, nickel, and mercury, which were commonly exceeded in the reference marine sediment taken from Brookings Bay. Concentrations of other metals (i.e., copper, lead, and zinc), polychlorinated biphenyls (PCBs), pesticides, and semivolatile organic compounds (SVOCs) were associated with the sediment within the forebay. The forebay sediments were removed in fall 2003 as part of radiological remediation activities (MYAPC, 2005b).

Tissue samples were collected from shellfish in the intertidal and subtidal zones around Bailey Point to assess the impact of stormwater discharge to biota in the Back River and Bailey Cove environments. Samples were collected from mussels, clams, lobster, and lobster tomalley and were analyzed for metals, PCBs, pesticides, and SVOCs. Tissue samples were

also collected from clams and mussels in the intertidal and subtidal zones from a reference location and analyzed for the same constituents.

The carcinogenic risk estimates for ingestion of shellfish exceeded both the MDEP target risk level of 10^{-5} and the EPA target risk range of 10^{-6} to 10^{-4} for all species. Constituents present in shellfish tissue at concentrations exceeding an individual cancer risk of 10^{-5} included arsenic in all species and total PCBs in tomalley. Reference samples of clams and mussels were collected from areas outside the influence of Maine Yankee and used to compare the concentration of chemicals detected in the clams and mussels collected from the Back River. The carcinogenic risk estimates based on exposure to the contaminants in the reference samples are similar to the risk estimates based on exposure to contaminants in the site samples. Many of the contaminants detected in the clams and mussels collected from the Back River were also detected at similar concentrations in clams and mussels collected from the reference locations (MYAPC, 2004). In conclusion, it should be noted that the risk from ingestion of shellfish collected around Bailey Point are indistinguishable from background risks and are not attributed to activities conducted at Maine Yankee (MYAPC, 2005b).

3.1.8 Exposure Setting in Offsite Sediments – Marine Sampling Study

Under an agreement with the State of Maine and the Friends of the Coast, Maine Yankee conducted a study in the intertidal zone surrounding selected portions of Maine Yankee property. This sampling effort involved a search for areas high in nuclear radiation (hot particle search) and included samples from the surface of the tidal region, core samples from the tidal region, and samples of biota including seaweed, lobsters, mussels, and fish. In all, about 600 samples from 147 locations were collected and analyzed.

Before sample collection began, a model of the bay was developed to evaluate the effect of tidal influences on releases of radioisotopes. The model took into account the action of the tides, the flow of water, and the discharges from various points. The work was necessary due to the changes made over time to the plant. In particular, three separate discharge points were used as well as the removal of a causeway over the lifetime of the plant. A theoretical model was developed to identify the location of the hottest zones for radioisotopes. This model was tested using floats to validate the results. The predictions of the model became the points for the first sampling effort. After measuring this first set and refining the model, a second sampling effort was accomplished based on the results of the first set. In this manner, a coordinated study was possible.

Sediment sampling was conducted to search for localized areas high in radiation. To accomplish this goal, an instrument that measures radiation exposure, called a High Pressure Ion Chamber (HPIC), was used. The HPIC was placed on a sled and dragged across the mud flats at low tide. Three sets of measurements were taken. These sets were placed so that the HPIC system would pass close to the discharge points. If a single measurement of three times background was found, the HPIC would signal the researchers that a hot spot was found. No such measurement was found. In fact, the exposure seen away from shore was, in general, less than the background seen on shore. This is likely because of sediment mixing caused by the action of tides and the turnover of sediment from clam or worm digging.

The next set of results involved the analysis of the samples taken from the surface of the intertidal zone. These samples were analyzed for certain radioisotopes associated with nuclear fission, including Cs-137 (cesium radioisotopes) and Co-60 (cobalt radioisotopes). As expected, these were the predominant radioisotopes observed. The results were compared to measurements taken earlier. In general, the values obtained were lower than before the plant was brought on line, probably because of mixing within the tidal flat, lowering the amount of radiation on the surface. The distribution of cesium and cobalt is also consistent with the history of discharges. The cobalt concentration was highest near the recently used diffuser. Because cobalt has a relatively short half-life, very low levels were expected at locations where discharges were stopped and the highest level where discharges were more recent. Cesium, with a longer half-life, was expected to be higher at locations that had more discharges. Overall, the greatest concentration of plant-derived radionuclides was in Bailey Cove and the area of the diffuser. Bailey Cove was the original plant discharge location prior to installation of the diffuser. The distribution is consistent with these assumptions.

Core samples were also taken, sectioned, and counted. The results show that overall radiation is low. An individual core was sectioned and counted to determine how far into the soil the highest level of radiation exists. Most radiation was found below the surface, which is consistent with results from surface samples. Again, the data indicate that a mixing of the soil is occurring so that radioisotopes are distributed and do not remain localized.

In comparison, naturally occurring radionuclides such as K-40 (potassium) were found at higher levels in the marine environment than either cesium or cobalt. The average naturally occurring potassium concentration was about 10 picocuries per gram (pCi/g), which results in an exposure rate of approximately 8 mrem/year. The average cesium or cobalt concentration was about 0.073 pCi/g or 0.019 pCi/g, which results in an exposure rate of approximately 0.17 mrem/year or 0.13 mrem/year, respectively, using NRC-approved soil screening values.

Biota samples also were taken and analyzed. These samples included lobsters, clams, mussels, seaweed, and fish. The samples were crushed and analyzed for the same radioisotopes as above. For the shellfish, the shells were counted separately from the meat. Additionally, these samples were sent to another laboratory to search for radioisotopes, such as beta emitters and plutonium, which are difficult to measure (hard to detect). The results showed that all levels were very low, including the hard-to-detect values.

As a final calculation, the results of these samples were used to calculate the average and peak doses that an individual would receive if he/she stood on the tidal flat, went swimming, went fishing, harvested seaweed, or ingested the biota. The results ranged between 3 mrem/year for land reclamation to 2.6×10^{-3} mrem/year for swimming. Such exposures are a small fraction of normal exposures received naturally through a year. The low exposures are indicative of the low values seen in the data sets.

Further discussion of the cumulative risks in the shoreline areas is presented in Section 6.

3.2 Identification of Potentially Exposed Individuals and Exposure Pathways

This subsection contains a preliminary discussion of the types of individuals assumed to be potentially exposed to plant-derived radionuclide and chemical contaminants. The potential exposure pathways that will be evaluated in the cumulative risk assessment for each of these human receptors are also identified. These represent a starting point for identifying the human receptors that will be evaluated quantitatively in the cumulative risk assessment, and the exposure pathways that are deemed to be complete.

3.2.1 Onsite Worker Scenario

Future industrial land use assumes that the site will be covered by new buildings, landscaping, or pavement. Portions of the surface soil may remain unpaved, depending on future uses selected. Groundwater use would be prohibited, and it is assumed that there will be no complete exposure pathways from groundwater. Exposure pathways through the food chain originating from onsite sources are assumed to be incomplete.

Two types of exposed adult individuals were considered under this land use description:

- **Building Occupants:** These individuals spend most of their time indoors. Time spent outdoors (transit to or from vehicles; time spent outdoors for lunch) are assumed to be minimal and would not be included in calculations of potential exposures or risks.
- **Groundskeepers:** The property is assumed to have landscaped or unpaved areas that are maintained by employees on a regular basis or employees whose primary duties are performed outdoors. These work activities result in these individuals being outdoors for a substantial portion of the year.

The grounds keeper would experience the higher levels of exposure (hence, higher risks) because direct contact exposure pathways (soil ingestion, inhalation and, for chemicals, dermal contact with soil) would more likely be complete, and the time spent outdoors would be associated with less shielding from the external exposure pathway. Exposures and risks estimated for a groundskeeper are considered conservative for other groups of workers. Therefore, it is proposed that building occupant exposures not be calculated as part of the cumulative risk assessment.

3.2.2 Onsite – Residential Scenario

Future residential use is based on the assumption that individuals could be exposed from direct contact (soil ingestion, inhalation and, for chemicals, dermal contact with soil), external exposure to gamma radiation (both indoors and outdoors), ingestion of home-grown vegetables, and possibly ingestion of groundwater. Although radionuclides were not identified as COPCs in groundwater (see Section 4.2), radionuclides in groundwater are monitored at the site, as discussed in Section 3.1.5. In addition, the cumulative groundwater risk was calculated using both radiological and chemical risks (see Table 6-2). Methods for calculating radiological cancer risk from ingesting groundwater are presented in Section 6.3.2.

3.2.3 Offsite Scenario: User of Shoreline Area

The most likely exposure scenario offsite from the Maine Yankee facility is expected to involve wading, clamming or harvesting bait worms along the shore areas, tidal flats, and water areas surrounding Bailey Point. Potential pathways of exposure for this offsite scenario could include direct exposure from radionuclides, and ingestion of radionuclides or chemical contaminants in sediments or biota (seafood). Seafood consumption could include clams harvested from the mudflats by visitors or consumption of commercially harvested crab, lobster, or shellfish. Potential receptors may be considered to be adults wading in the water, clamming or harvesting bait worms, or consuming seafood harvested commercially from this area.

3.2.4 Construction Worker

The adult construction worker represents an onsite exposure scenario. It is assumed that construction workers could experience higher exposure levels over short periods of time while performing activities that involve disturbing soil. Construction of surface facilities or short-duration excavation projects (for example, installation or repair of utilities) may have requirements for protection of workers or the environment from site-specific contaminants of concern. The construction worker could be exposed from direct contact (soil ingestion, inhalation, and, for chemicals, dermal contact), and external exposure to gamma radiation. It was assumed that there will be no complete exposure pathways from groundwater, and exposure pathways through the food chain originating from onsite sources are also assumed to be incomplete.

3.3 Independent Spent Fuel Storage Installation

Maine Yankee licensed and built an ISFSI for the storage of spent nuclear fuel generated during the operation of the plant. Because the goal of the decommissioning was demolition of plant structures, including the spent fuel building, it was necessary to remove the spent fuel that was stored in the spent fuel pool. The ISFSI was constructed to provide safe storage for Maine Yankee spent fuel and Greater Than Class C (GTCC) waste from irradiated reactor internals until the Department of Energy or another entity licenses and constructs a high-level waste disposal facility or temporary storage facility.

The ISFSI operation represents an ongoing activity that is licensed and monitored in accordance with federal regulations. For the purposes of meeting security obligations under federal regulations, Maine Yankee has committed to a controlled area boundary of 300 meters, or 984 feet.

Radiological dose measurements show that operation of the ISFSI will not contribute to cumulative risk from the Maine Yankee decommissioning. These measurements show that doses resemble background levels outside of the 300-meter controlled area boundary. In addition, there will be no impact to members of the public who may infrequently be within the 300-meter boundary, performing commercial or recreational activities on or near the Back River shoreline in the vicinity of the ISFSI.

The cumulative risk assessment for the ISFSI is presented in Appendix C.

4. Identification of Constituents of Potential Concern

The COPCs were selected to focus the risk assessment on compounds that presented the greatest health concern. The COPCs represent chemical or radiological contaminants that are detected frequently in environmental media and detected consistently at levels that are higher than risk-based screening levels. In general, the COPCs are a subset of all contaminants detected in each medium. The following sections describe how COPCs for chemicals and radionuclides in different media will be identified for further evaluation in the cumulative risk assessment.

4.1 COPC Identification - Chemicals

The COPCs in the HHRA were selected using the criteria presented in the HHEA Work Plan (**Appendix H-1** of the Bailey Point RFI report). The COPCs in the HHRA were selected from the data set presented in **Sections 3.0 and 4.0** of the Bailey Point RFI report. The analytical results from samples collected within each study area/medium were subjected to standard EPA data validation and quality control review and were used to select COPCs consistent with the HHEA Work Plan and EPA guidance as discussed in **Section 5.3** of the Bailey Point RFI report.

Those chemicals that met the following criteria were eliminated as COPCs (see Section 5.3 of the Bailey Point RFI report for a full description).

- Frequency of Detection. Consistent with EPA guidance (EPA, 1989), compounds detected at a low frequency of detection (less than 5%), were eliminated as a COPC and apply only to data sets with more than a total of 20 samples.
- Comparison to Risk-Based Concentrations. Consistent with EPA Region I guidance, compounds detected in various media at concentrations below appropriate risk-based concentrations (RBCs) were eliminated as COPCs. The risk based concentrations used in the HHRA were based on a cancer risk of 1×10^{-6} and were obtained from one of the following sources: EPA Region 9 preliminary remediation goals (PRGs); MBOH fish tissue action levels, or EPA Region 3 RBCs (EPA, October, 2002 and MBOH, 2001).
- Essential Nutrients. Several of the metals detected in soil and sediment at the Maine Yankee Facility are essential human nutrients and include magnesium, calcium, and potassium (EPA, 1989). According to EPA guidance, these chemicals can be eliminated from consideration in the quantitative risk assessment. Therefore, magnesium, calcium, and potassium were not included as COPCs.
- Insufficient Toxicity Information. Some of the chemicals detected at the site lack sufficient toxicity information to complete a quantitative risk evaluation. These compounds were identified as COPCs, carried forward in the risk evaluation, and were discussed in the Uncertainty and Limitations section of the HHRA. All of the chemicals

addressed in the CRA had sufficient toxicity information for quantitative evaluation of health risks.

- Reference Concentrations. Reference soil samples were collected from areas outside the influence of the Maine Yankee site and used to compare concentrations of chemicals detected in the various study areas. Reference concentrations for the Target Analyte List (TAL) metals detected in soils were identified and discussed in Section 4.1 and presented in Table 4-2 of the Bailey Point RFI report. Of particular interest in this risk assessment are the presence of arsenic and iron in the soils. These metals are naturally occurring elements present in all soils in this area. Neither metal is related to plant operations. Although reference concentrations were not used in selecting COPCs, potential risks attributable to reference conditions were considered in this risk assessment.

Polycyclic aromatic hydrocarbon (PAH) and PCB compounds were addressed in the cumulative risk assessment in the following manner: the concentration of each of the seven carcinogenic PAH compounds (benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene and indeno(1,2,3-c,d) pyrene) was modified by its toxic equivalent factor and summed to yield a benzo(a)pyrene equivalent concentration (see Section 5.5.3 of the Bailey Point RFI report for a discussion of toxic equivalent factors). It is referred to as “carcinogenic PAHs (cPAHs)” in the text. The individual aroclor concentrations were summed to yield a total PCB concentration. The carcinogenic COPCs in different contaminated media are summarized in Table 4-1.

- Soil. Compounds retained as COPCs in soil in at least one study area within Bailey Point were arsenic, total PCBs, and cPAHs. A summary the RFI data in soil is presented in Table 4-2.
- Groundwater. COPCs in groundwater samples collected from monitoring wells placed throughout Bailey Point were 1,2-dichloroethane, benzene, bromodichloromethane, trichloroethene and vinyl chloride. A summary of the RFI data in groundwater is presented in Table 4-3.
- Sediment. Compounds retained as COPCs in sediment were arsenic and cPAHs. A summary of the RFI data in sediment is presented in Table 4-4.
- Shellfish. Compounds retained as COPCs in tissue samples collected from shellfish in the intertidal and subtidal zones around Bailey Point were arsenic, total PCBs, total PCBs (Arochlor 1260 only), alpha-hexachlorocyclohexane, beta-hexachlorocyclohexane, 4,4'-DDE, dieldrin, heptachlor epoxide, and cPAHs. A summary of the RFI data in tissue samples is presented in Table 4-5.

4.2 COPC Identification – Radionuclides

The radiological site characterization (see Section 2 of the LTP) identified the nuclide profile of all the detectable radionuclides present in each media and their relative fractions to one another. The nuclides in different contaminated media are presented in Table 4-6. These formed the initial list of radionuclides that will be evaluated for selecting a focused list of COPCs for the cumulative risk assessment.

From this list, the criteria for including or excluding radionuclides as COPCs in the cumulative risk assessment involved the following steps:

- Radionuclides that were not detected in affected media (soil or groundwater) were not included as COPCs
- Radionuclides that were indistinguishable from background levels were not included as COPCs (see the background section, below)
- Radionuclides were found to provide small contributions to risk, based on an analysis of dose contributions (see Section 2.5.3.c of the LTP)

The results from these steps are summarized in the following paragraphs.

Surface Soil and Deep Soil. As a part of the radiological site characterization (see Section 2 of the LTP), soil from the areas with the highest contamination levels were composited and analyzed for nuclide content. The results of the surface (within 15 cm of the surface) and deep (below 15 cm of the surface) soil sampling indicated that the radionuclides present in surface and deep soil were H-3, Ni-63, Co-60, and Cs-137, as shown in Table 2-11 of the LTP. For additional discussion on soil samples and nuclide fraction, see Attachment 2I of the LTP.

A dose assessment (see Section 6 of the LTP) was conducted to develop derived concentration guidance levels (DCGLs) for all of those radionuclides. The DCGLs are the levels of residual radioactivity that correspond to the enhanced state clean-up criteria of 10 mrem/year or less for all pathways (based on a resident farmer scenario) and 4 mrem/year or less for groundwater sources. The dose assessment also identified the media and radionuclides that provided the largest contributions to total dose. Therefore the LTP conservatively accounted for the range of plant-derived radionuclides that could be in environmental media at Maine Yankee.

As shown in Tables 4-8 and 4-9, the relative contribution to total dose of radionuclides in different media indicates that Cs-137 and Co-60 in soil could provide the most significant contribution to cumulative risks.

From the radionuclide-impacted media, surface soil and deep soil provide the largest contribution to total annual dose. Surface soil contributed 69 percent and deep soil contributed 25 percent of the total annual dose (see Table 4-3). Combined, the remaining media contribute only 6.2 percent of the total annual dose. In the surface soil, Cs-137 is the main contributor to total annual dose, providing 96 percent of the total (see Table 4-8). Co-60 is the next largest contributor, providing 2.8 percent of the total. H-3 and Ni-63, combined, contribute less than 1 percent to the total annual dose. Therefore, the COPCs in soil that were evaluated for the cumulative risk assessment are Cs-137 and Co-60. Summary statistics for these radionuclides are summarized for each survey unit in Table 4-9.

Groundwater and Surface Water. Tritium has been the radionuclide detected primarily in either groundwater or surface water. The range of H-3 concentrations identified during characterization sampling of site wells was 441 pCi/l to 6812 pCi/l, which is for the most part consistent with background levels (MYAPC, 2005a). Low levels of Co-60 and Cs-137 have been detected sporadically in the containment foundation sump and other site wells; however, these radionuclides were not included in the nuclide fraction (see LTP Table 2-12,

MYAPC, 2005a). The available data from the radiological groundwater monitoring program (MDEP [Littell] letter to Maine Yankee [Feigenbaum] dated June 23, 2004, "Radiological Groundwater Monitoring Agreement") was used to identify the radionuclide COPCs in groundwater. These data are summarized in Table 4-10.

In addition, Maine Yankee intends to place an institutional control on all of Bailey Point, limiting future land use to commercial/industrial activities. This control also would prohibit groundwater use on Bailey Point by preventing the installation of water supply wells within the area of contaminated groundwater. These institutional controls would be implemented through a restrictive covenant (MYAPC, 2005a).

Biota. Data describing radionuclide COPCs in biota were obtained from the characterization of radionuclides in the Back River and intertidal zone around the former Maine Yankee facility (MYAPC, 2005c). Sediment and biota samples were collected for analysis of radionuclides as part of this study. Biota samples, including lobsters, clams, mussels, seaweed, and fish, were collected and analyzed for radionuclides, including the predominant fission products in soil, Cs-137 and Co-60. Maximum radionuclide levels in sediment and biota detected in this study were 10- to 30-fold lower than concentrations detected during studies conducted in 1972 and 1974, prior to the startup of the Maine Yankee facility. Radionuclide levels were lower in surface sediment samples compared with deeper sediments. The sediment cores showed double peaks, one from early 1957-69, and a second peak in 1983-85, mainly from fallout events.

The results from these studies, which indicated lower levels of radionuclides following operation of the facility, were used to evaluate the cumulative risks from aquatic biota or sediments potentially attributable to plant-derived chemical contaminants and radionuclides at the Maine Yankee facility.

5. Exposure Assessment

The purpose of the exposure assessment is to estimate the magnitude of potential exposure to site-related contaminants present at the site. This exposure assessment is based on scenarios that define human populations potentially exposed to a focused list of COPCs that may be present. The potential pathways of exposure, frequency and duration of potential exposures, rates of contact with environmental media, and concentrations of chemicals and plant-derived radionuclides in those media are considered in the exposure assessment. Constituent intakes and associated risks will be quantified for all exposure pathways considered potentially complete. This section describes the assumptions, data, and methods used to evaluate the potential for human exposure to the focused list of COPCs present at the site. The process involves the following steps:

- Identification of potential exposure pathways and selection of complete exposure pathways
- Estimation of exposure point concentrations used to quantify contaminant intakes
- Quantification of chemical and radionuclide contaminant intakes for each exposure pathway
- Quantification of dose associated with radionuclide exposures

5.1 Identification of Potential Exposure Pathways

The groups of potentially exposed individuals addressed in the cumulative risk assessment are identified in Section 3.2. Potentially complete exposure pathways evaluated in the cumulative risk assessment are presented in Table 5-1. Some of the pathways listed in Table 5-1 were identified as not complete, or as providing a very small contribution to cumulative risks.

Contaminant migration in groundwater to offsite locations, and potential exposures to off-site shoreline users to groundwater contaminants, was considered to be an incomplete exposure pathway. Groundwater sampling from locations where significant industrial activity has occurred has demonstrated that radiological groundwater quality has not been significantly affected by the long-term industrial activities at the site. Furthermore, it is reasonable to assume that transport processes, including travel times from onsite areas to shore areas, and dilution resulting from groundwater/surface water interaction, would result in extremely small exposures to radionuclides, even if groundwater contaminants were present.

The HHRA evaluated exposure to chemicals detected in groundwater under a future potential residential land use scenario. As stated therein, it is unlikely that Bailey Point will support future residential land use. Also, institutional controls will be put into place restricting future use of groundwater. These factors suggest that the calculated risk estimates are an overestimate of actual future risks from exposure to groundwater. The

estimated cancer risk was 5.1×10^{-5} under a central tendency exposure scenario. This risk estimate was used to evaluate cumulative risks from radionuclides detected in groundwater during the radiological groundwater monitoring program.

5.2 Estimation of Exposure Point Concentrations

The steps involved with estimating exposure point concentrations will be:

- Selection of the exposure area to be evaluated in the cumulative risk assessment
- Calculation or selection of the representative concentration

5.2.1 Selection of Exposure Units

The exposure units (described in Section 3.1) defined how analytical data were grouped for purposes of calculating or selecting exposure point concentrations and estimating health risks. In general, exposure areas were placed at the locations where the highest radionuclide and chemical concentrations in combination had been detected at the facility. The exposure units addressed in the cumulative risk assessment are shown in Table 3-1. Potential exposures of onsite workers, onsite residents, and construction workers were evaluated for the four exposure units listed in Table 3-1. The HHRA, conducted as part of the RFI, defines the areas of the former facility where chemical risks were evaluated. As discussed in Section 3.1, these areas were overlain onto survey areas developed for the final status survey, to superimpose estimated risks for both chemicals and radionuclides in soil.

5.2.2 Calculation of Exposure Point Concentrations

The exposure point concentrations for radionuclides were the arithmetic average of analytical results for contaminants within the survey area. Selection of the average concentration is considered the most representative of the dose and risk from external exposure, the primary exposure pathway associated with the COPCs in soil (Cs-137 and Co-60).

The exposure point concentrations for chemical contaminants were calculated as averages. Use of the average concentration was consistent with the central tendency exposure scenario presented in the HHRA (MYAPC, 2004). In addition, use of the average concentration for the chemical constituents is consistent with the estimation of radionuclide concentrations (also estimated as averages) within each survey unit.

5.3 Quantification of Contaminant Intake

Chemical contaminant intakes were quantified using intake equations described in EPA guidance, as shown in the HHRA. Examples of these equations for chemical intakes are presented in the RFI report (MYAPC, 2004), which contains the risk assessment methodology for the RCRA closure.

Radionuclide intakes were quantified using equations developed for EPA's radionuclide soil screening guidance (EPA, 2001a). These equations are shown in Appendix D. Table 5-3 presents the assumptions used to calculate produce ingestion in the HHRA (based on

guidance in EPA, 1998) and that was also used for the cumulative risk assessment. That produce rate was selected to provide consistency with the exposure factors used to estimate exposure for both chemicals and radionuclides in soil.

There are many alternative ways to characterize produce ingestion. These include:

- NUREG/CR-5512 (NRC, 1992), which provided the technical basis for the DCGLs presented in the LTP (MYAPC, 2005a).
- EPA *Soil Screening Guidance for Radionuclides: User's Guide* (EPA, 2001a and
- EPA's *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (EPA, 1998).

The cumulative risk assessment, as with the HHRA (MYAPC, 2004), uses produce ingestion assumptions from EPA 1998 guidance. The calculation of the produce ingestion rate used in the HHRA, as derived from the EPA guidance, is shown in Table 5-3. The three sets of produce ingestion assumptions are shown in Table 5-4. Soil-to-plant transfer coefficients for radionuclides can be drawn from two sources. EPA 2000 uses, for each radionuclide, one factor for all plant types. NRC 1992 uses, for each radionuclide, factors specific to plant type (fruit, root, or leafy vegetable). The cumulative risk assessment uses the soil-to-plant transfer factors from EPA 2000.

Between the three sets of produce ingestion assumptions and the two sets of soil-to-plant transfer factors, there are six possible ways to calculate crop ingestion risks. Appendix D gives sample calculations for three of these combinations for one survey unit, SU26.

There are distinct differences between the guidance documents in the assumptions used for estimating risks through the produce ingestion pathway. A comparison of the assumptions is presented in Table 5-4. A comparison of the risks with these different methodologies has been presented in Appendix D. The results from that comparison are shown below:

Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Produce Ingestion Risks		
			Cumulative Risk Assessment Methodology, drawn from MYAPC, 2004 HHRA	NUREG CR-5512 Methodology	EPA Soil Screening Guidance Methodology
Cs-137	1.24E-01	8.96E-02	1.04E-07	6.41E-07	1.90E-07
Co-60	5.45E-01	1.36E-01	1.87E-07	1.58E-07	3.43E-07

Note: these example calculations are presented for a single survey unit, SU-26, in the Forebay (see Table 3-1).

It can be seen from this summary (and from Table 3b) that the methodology used for the cumulative risk assessment and EPA's Soil Screening Guidance methodology produce similar ingestion risk estimates for Cs-137. The methodology used in NUREG/CR-5512,

which is consistent with the methodology used to develop DCGLs in the LTP produces higher risk estimates for Cs-137. This is because the NUREG/CR-5512 methodology has a higher leafy produce ingestion rate, and a higher soil-to-plant transfer coefficient for leafy produce. However, beyond the risks from ingestion of leafy vegetables for Cs-137, the three methodologies appear to produce similar risk estimates from produce ingestion.

Produce ingestion risks were compared with risks from the external exposure pathway in Appendix D. External exposure provides the largest contribution to total doses from Cs-137 and Co-60. As shown in that table, risks from produce ingestion generally are 1 to 10 percent of the risks from external exposure, with the exception of risks from produce ingestion for Cs-137 when estimated using the NUREG/CR-5512 methodology.

5.4 Calculation of Radiation Dose

Lifetime exposures from radionuclides were converted to total effective dose equivalents using dose conversion factors presented in Federal Guidance Report No. 11 (EPA, 1988), for ingestion and inhalation exposure pathways, and Federal Guidance Report No. 12 (EPA, 1993) for external exposure. These represent the dose conversion factors approved for use by NRC (NRC, 2000) in decommissioning and used in the LTP dose assessment. As discussed below, the dose estimates were converted to excess lifetime cancer risks estimates, which are then comparable with cancer risks estimated for the chemical contaminants.

6. Cumulative Risk Evaluation

Chemical contaminants are potentially associated with increased cancer risks and the potential for adverse noncancer health effects. Radionuclides are primarily associated with increased cancer risks. Therefore, cumulative risks from chemical intake and radioactive doses will be evaluated in terms of increased lifetime cancer risks. The steps involved with the cumulative risk evaluation are:

- Calculation of increased lifetime cancer risks associated with intake of chemical contaminants
- Calculation of increased lifetime cancer risks corresponding to the dose from radionuclide contaminants
- Risk characterization: comparison and summation of the chemical and radionuclide risks, and discussion of uncertainties in the risk evaluation.

6.1 Evaluation of Cancer Risks – Chemicals

The EPA Carcinogen Assessment Group has developed carcinogenic slope factors (CSFs) for compounds classified as known, potential, or possible human carcinogens. The EPA's Integrated Risk Information System (IRIS) database maintains a current listing of all the verified CSFs and was the primary source of information for this section. CSFs for compounds not listed on IRIS were obtained from EPA Region I, the National Center of Environmental Assessment (NCEA), or Health Effects Summary Tables as presented in the EPA Region 9 PRG table (EPA, 2003, EPA NCEA website, April 2003, and EPA Region 9 website, October 2002).

6.2 Evaluation of Cancer Risks – Radionuclides

Cancer risks from radionuclide exposures were calculated by multiplying total effective dose equivalents (described in Section 5.4) by a risk coefficient. The following subsections provide a brief background regarding development of the coefficient and a description of how the calculations will be performed.

6.2.1 Development of Risk Coefficients

Coefficients relating dose to risk were used in this cumulative risk assessment to estimate risks directly from dose estimates developed using the exposure methodology in NUREG CR-5512 (NRC, 1992), and the dose conversion factors in Federal Guidance Report 11 (EPA, 1988) and Federal Guidance Report 12 (EPA, 1993). These coefficients grew out of the 1990 recommendations of the ICRP (ICRP, 1991). The intended purpose for developing risk coefficients was to develop organ weighting factors to calculate total dose from internal and external doses, for purposes of refining radiation protection standards. According to the 1990 recommendations of the ICRP, the probability coefficient from fatal cancers, nonfatal

cancers, and severe hereditary effects is 7.3×10^{-2} /sievert, or 7.3×10^{-7} /mrem (1 sievert = 100,000 mrem). This risk coefficient is based on low, linear energy transfer (LET) (gamma) radiation (not appropriate for some radionuclides). It considers all cancers and includes consideration of societal factors associated with nonfatal cancer risks. The calculation that can be used to derive risk from a given dose is:

$$\text{Cancer risk} = \text{dose (mrem)} \times \text{risk coefficient (risk / mrem)}$$

EPA developed coefficients to convert dose to risk in support of its regulatory programs, which involved calculation of cancer risks associated with exposure to radionuclides (EPA, 1994a). EPA examined only fatal and non-fatal cancer risks in development of its coefficients, and did not include the societal factors considered by ICRP. Refinements of EPA's concepts were presented in Federal Guidance Report No. 13 (EPA, 1999, which discussed risk coefficients based on the fatal cancer risk (5.75×10^{-7} /mrem) and cancer incidence (8.46×10^{-7} /mrem).

6.2.2 Use of Risk Coefficients in the Cumulative Risk Assessment

For purposes of this cumulative risk assessment, a risk coefficient of 8×10^{-7} /mrem, which relates total effective dose equivalent to increased incidence of cancer risk, was used to calculate risks from radionuclides. Use of the cancer incidence coefficient is considered to be more consistent with CSFs for chemical carcinogens (CSFs are based on cancer incidence). External exposure provides the largest contribution to total dose (as described previously, the primary radionuclide COPCs are the gamma emitters Cs-137 and Co-60). The external exposure pathway is consistent with the assumption of uniform low-LET whole body dose. Therefore, for purposes of evaluating and comparing risks from radionuclides with chemical contaminant risks, it is considered feasible to directly relate estimated doses as increased lifetime cancer risks where external exposure is the primary pathway of radionuclide exposure.

6.2.3 Development of Radionuclide Cancer Slope Factors

An alternative approach calculates directly radionuclide-specific cancer risk estimates using cancer slope factors. Unless evidence to the contrary exists, if a carcinogenic response occurs at the exposure levels studied (typically high doses), it is assumed that responses will occur at all lower doses. Exposure to any level of a carcinogen is then considered to have a finite risk of inducing cancer. Because risks at low levels of exposure cannot be quantified directly by either animal or epidemiological studies, mathematical models are used to extrapolate from high to low doses. These mathematical models provide numerical estimates of cancer potency referred to as cancer slope factors (CSFs). Under an assumption of dose response linearity at low doses, the CSF defines cancer risk due to continuous constant lifetime exposure to one unit of carcinogen (in units of risk per mg/kg-day). Individual cancer risk was calculated as the product of exposure to a radionuclide (in pCi) and the CSF for that radionuclide (in pCi)⁻¹.

EPA's Office of Radiation and Indoor Air (ORIA) calculates radionuclide CSF values using health effects data and dose and risk models from a number of national and international scientific advisory commissions and organizations, including the National Academy of Sciences (NAS), the National Council on Radiation Protection and Measurements, the

United Nations Scientific Committee on the Effects of Atomic Radiation, and ICRP. A detailed discussion of ORIA's approach and assumptions is provided Federal Guidance Report 13 (EPA, 1999).

Radionuclide CSFs are calculated for each radionuclide individually, based on its unique chemical, metabolic, and radioactive properties. The calculation uses dose estimates from EPA's computer code RADRISK, vital statistics from the U.S. Decennial Life Tables, and cancer risk estimates based largely on the results of the NAS Biological Effects of Ionizing Radiation V report, ICRP Publication 60, and NRC analyses. Ingestion and inhalation cancer slope factors for radionuclides account for:

- The amount of radionuclide transported into the bloodstream from either the gastrointestinal tract following ingestion, or from the lungs following inhalation
- The ingrowth and decay of radioactive progeny produced within the body subsequent to intake
- The distribution and retention of each radionuclide (and its associated progeny, if appropriate) in body tissues and organs
- The radiation dose delivered to body tissues and organs from the radionuclide (and its associated progeny, if appropriate)
- The sex, age, and organ-specific risk factors over the lifetime of exposure

6.3 Risk Characterization

The results of the cumulative risk assessment are presented for the following site areas:

- Onsite areas – the industrial portion of the facility
- Offsite areas – shellfish consumers from the shoreline surrounding the facility
- ISFSI
- Backlands Area

6.3.1 Cumulative Risks – Soils in Onsite Areas

The quantitative results for soils in onsite facility areas are summarized in Table 6-1. Detailed presentation of the cumulative risks in soil can be found in Appendix E. In general, cumulative risks were driven by the chemical constituents in soil. On average, radionuclide risks for the residential scenario were approximately 1 percent of the cumulative risk; the large contribution to chemical-related risk in this scenario is based on the plant ingestion pathway.

Radionuclides in soil did not result in a significant cumulative risk across the site.

6.3.1.1 Evaluation of Areas with No Chemical Cancer Risk Estimates in Soil

Chemical contaminants are potentially associated with increased cancer risks and the potential for adverse noncancer health effects. Radionuclides are primarily associated with

increased cancer risks. Therefore, cumulative risks from chemical intake and radioactive doses have been evaluated in terms of increased lifetime cancer risks.

In some areas of the facilities, no constituents in soil were identified as chemical carcinogens, or the concentrations detected were sufficiently small to preclude further evaluation in the HHRA. The risks associated with exposure to soils in three areas of the facility (Foxbird Island – EU-7, the forebay – EU-8, and the former truck maintenance garage – EU-5, as described in Table 3-1) were not evaluated as part of the HHRA. RCRA constituents were found to be below project action limits in soil samples from Foxbird Island. The forebay has undergone significant radiological-driven soil remediation. Only petroleum hydrocarbons were detected in soils at the former truck maintenance garage.

In addition, the risks associated with exposure to soils at the parking lot areas – EU-6 were evaluated by comparing detected concentrations to the MDEP Remedial Action Guidelines concentrations. Soils present at concentrations at or below the Remedial Action Guidelines generally do not require remedial action. This type of risk evaluation was considered appropriate because sampling and analytical results support the conclusion that these areas have not been adversely affected by industrial site activities.

Foxbird Island

Analytical results of soil samples from Foxbird Island showed that iron was the only chemical constituent that exceeds its project action limit.¹ However, iron concentrations in soil were within the range of observed background concentrations. Organic compounds were not detected. The results from the RFI indicated that no RCRA issues were present on Foxbird Island and that no additional characterization was necessary (MYAPC, 2004).

Forebay

The soil and sediment results have indicated minimal impact of RCRA constituents in the forebay. In addition, the forebay had undergone significant remediation that was driven by radionuclides. In support of site decommissioning activities, the forebay remediation was completed in December 2003. The remediation was driven by the presence of radionuclides, and the remediation activities included removal of the upper 10 feet of both dikes and removal of approximately 977 cubic yards of sediment. The forebay was backfilled and graded, and the west dike was breached to form a 1.3-acre wetland. Final grading of the forebay was completed in April 2004. Samples taken from the remaining sediments following sediment removal activities in the forebay showed that metal concentrations were either consistent with background soil concentrations or below state remedial action goals for residential land use. Low concentrations of SVOCs and PCBs detected in soil also were below the remedial action goals. As a result of the remediation activities completed in the forebay, this area was not addressed in the HHRA (MYAPC, 2005b).

The radiological survey units in the forebay are 2 to 3 feet below the remaining surface. These survey units, identified as SU-28 and SU-29 in Figures 3-2 and 3-4, were surveyed using underwater in-situ gamma spectroscopy methods, and the results were evaluated by an excavation dose assessment, as described in the LTP. Therefore, these survey units do not

¹ The project action levels were based on EPA Region 9 PRGs. These levels were developed using conservative exposure factors based on residential land use assumptions, and for carcinogenic substances, are based on a target cancer risk level of 1×10^{-6} .

represent surface radionuclides concentrations present for exposure, as described the exposure scenarios, and are not included in the calculation of cumulative risk.

Former Truck Maintenance Garage

The results for the former truck maintenance garage indicate the presence of elevated concentrations of petroleum hydrocarbons, although specific target compounds that could be used to evaluate site risk were below project action limits or had non-detect values (MYAPC, 2004). The petroleum hydrocarbon concentrations in soil indicated that further action was necessary for the former garage. Post-RFI characterization discussed in the CMS (MYAPC, 2005b) identified the limits of petroleum hydrocarbon-contaminated soil. The detected petroleum hydrocarbons included kerosene and diesel components. This variety of petroleum hydrocarbons had limited solubility, but were detected at relatively high concentrations that could have continued to degrade groundwater quality via infiltration and leaching processes. An interim action was conducted in July and August, 2004 to remove the petroleum-contaminated soils. The resulting action, which is described further in the CMS report, reduced petroleum hydrocarbon concentrations to below State action levels.

Parking Lot Areas

Twenty-four compounds were detected in the surface soil samples in the parking lot areas. Of these, six compounds (aluminum, arsenic, iron, lead, manganese, and sodium) were retained as COPCs because they either were present at concentrations exceeding their respective project action levels or lacked toxicity-based screening criteria. All other constituents were eliminated as COPCs because they were either detected at concentrations less than their respective project action levels or were considered essential nutrients. These constituents were evaluated by comparing them with State remedial action goals, and this area was not incorporated into the HHRA (MYAPC, 2004). Arsenic concentrations were higher than the remedial action goal, but were considered to be consistent with background levels in soil.

6.3.1.2 Uncertainties in Soil Risk Estimates

The principal uncertainty in the soil risk estimates is that the estimates of chemical risks are applied uniformly across the exposure unit, while the radionuclide risk estimates are presented on a more refined scale. The reason for this approach is the differences in characterization approach between the RFI and the FSS. The RFI assessment was conducted with the purpose of identifying the extent and concentration of COPCs in soil and groundwater at specific waste management units and resulting from industrial activities at particular locations within the site. The radiological assessment was conducted with the purpose of identifying the concentrations of radionuclides more uniformly in soil throughout the facility.

With this approach, the cumulative risk estimates will be more representative in the areas of the site where the RFI focused its characterization efforts. The uncertainties in the cumulative risk estimates will correspondingly be greater in the areas where RFI sampling had not been conducted. The site figures depicting the survey units (Figures 3-1 through 3-6) show the RFI sampling locations, and hence the areas where there may be more uncertainty associated with the cumulative risk assessment.

There are two approaches for characterizing radionuclide risks: the first involves calculating risks directly from radionuclide intake using CSFs developed using the methods in EPA's Federal Guidance Report 13. The second approach involves calculating doses, using the dose conversion factors in Federal Guidance Reports 11 and 12, then transforming the doses to cancer risks using a dose-to-risk conversion factor. This second approach was initially proposed in the *Cumulative Risk Assessment Framework* (MYAPC, 2002) to assure that the cumulative risk assessment results remained consistent with the dose assessment conducted in the LTP. Federal Guidance Reports 11 and 12 provided the dose conversion factors used in the LTP. A comparison of the risks between these two methods is shown in Appendix E. This comparison shows there is little difference in the estimated risks between these two approaches. Use of either method contributes very little uncertainty to the estimates of cumulative risk.

6.3.2 Cumulative Risks – Groundwater in Onsite Areas

The quantitative results for groundwater in onsite facility areas are summarized in Table 6-2. A detailed presentation of the radiological risk in groundwater can be found in Appendix F. Summaries of chemical and radiological monitoring results for groundwater can be found in Tables 4-3 and 4-10, respectively. In general, cumulative risks were driven by the chemical constituents in groundwater. In general, radionuclide risks for the residential drinking water scenario were less than 1 percent of the cumulative risk, except for radionuclides detected in MW-502 (2.3 percent).

Uncertainties in the assessment of cumulative groundwater risks are that all of the radionuclide groundwater monitoring wells are located within the Plant Area (EU-1 in Table 3-1), while the groundwater monitoring wells used to characterize chemical concentrations were distributed throughout Bailey Point. Therefore, the cumulative risk results for groundwater are most applicable within the Plant Area, EU-1.

6.3.2.1 Calculation of Groundwater Ingestion Radiological Cancer Risk

Groundwater ingestion risks related to radionuclides (presented in Appendix F) were calculated using the exposure factors listed below, and dose conversion or cancer slope factors presented in FGR-11 (USEPA, 1988) and FGR-13 (USEPA, 1999)²

6.3.2.2 FGR-11 Groundwater Ingestion Radiological Cancer Risk

As previously cited, the FGR-11 guidelines (EPA, 1988) address radionuclide risk management through a limiting dose of radioactivity in mrem. FGR-11 presents allowable concentrations of radionuclides per unit volume relative to a total allowable lifetime radioactivity dose. These allowable concentrations are derived via a dose conversion factor relating a dose equivalent in a target organ to the concentration of a radionuclide. For drinking water, the dose is calculated as follows:

$$Dose = DCF \times C_w \times IR_w$$

where

Dose = radionuclide intake in millirems (mrem) per year – mrem/year

DCF = radionuclide-specific Dose Conversion Factor – mrem/pCi

² Note that cancer slope factors from FGR13 are published in USEPA's HEAST tables <http://www.epa.gov/radiation/heast/>

C_w = radionuclide concentration in drinking water - pCi/L
 IR_w = drinking water intake - (1.31 L/day × 365 days/year) 478 L/year

Estimates of lifetime cancer risk are calculated by multiplying the dose in mrem per year by exposure duration in number of years and the dose-to-risk conversion factor cited in Section 6.2.2. The calculation is:

$$Risk = Dose \times ED \times CF$$

where

Risk = total lifetime risk of cancer - unitless
Dose = radioactivity intake - mrem/year
ED = exposure duration - 30 years
CF = dose-to-risk conversion factor - 8×10^{-7} risk/mrem

6.3.2.3 FGR-13 Groundwater Ingestion Radiological Cancer Risk

Cancer risk from exposure to radionuclides in drinking water is calculated using the cancer slope factors presented in FGR-13 (EPA, 1999) and referenced by the EPA in the Health Effects Assessment Summary Tables (HEAST) for radionuclides (<http://www.epa.gov/radiation/heast/>):

$$Risk = CSF \times C_w \times IR_w \times ED$$

where

Risk = total lifetime risk of cancer - unitless
CSF = nuclide-specific radioactivity cancer slope factor in drinking water- risk/pCi
 C_w = nuclide-concentration in drinking water - pCi/L
 IR_w = drinking water intake - 478 L/year
ED = exposure duration - 30 years

6.3.3 Cumulative Risks – Potential Onsite Residents

A summary of the quantitative risk results for potential onsite residents is presented in Table 6-3. The summary table provides radiological, chemical, and combined cumulative risks for soil ingestion, produce ingestion, external exposure, and groundwater ingestion. Note that risks to residents from exposure to groundwater are unlikely due to institutional controls preventing use of the groundwater.

6.3.4 Cumulative Risks – Offsite Areas

Future residential exposures to shellfish, including mussels, clams, lobsters, and lobster tomalley obtained from the intertidal and subtidal zones around Bailey Point were evaluated as part of the HHRA conducted for the RFI.

Risks from ingestion of shellfish caught near Maine Yankee and from reference areas were similar, both for chemical contaminants and radionuclides. Therefore, there are no offsite cumulative risks from shellfish consumption from either radionuclides or chemical contaminants.

6.3.5 Cumulative Risk from the ISFSI

As discussed in Section 3.2, the controlled area around the ISFSI prevents complete exposure pathways to chemical contaminants around that facility. Radiological dose measurements along the boundary of that controlled area show that doses resemble background levels. There are radiological and chemical risks within the ISFSI controlled area, but with the federally mandated owner control area, there are no available exposure pathways to the public. Therefore, operation of the ISFSI will not contribute to cumulative risk from the Maine Yankee decommissioning.

6.3.6 Backlands Area

A different approach to cumulative risk assessment was taken for the Backlands Area than is planned for Bailey Point, given the nature of the activities in that area. Risks associated with non-radiological chemical constituents detected in the Backlands Area were evaluated through site characterization activities, and were addressed under RCRA closure. RCRA closure activities are documented in the RFI report (MYAPC, 2004). The RFI report documents that chemical constituents are at background concentrations or below applicable MDEP risk-based levels with the exception of groundwater in the vicinity of Relic Dump 2. Maine Yankee monitors and restricts use of groundwater in the vicinity of Relic Dump 2. Monitoring and restrictions will remain in place until risk-based levels are achieved in accordance with an MDEP-approved plan. Radionuclides have been addressed under the LTP (MYAPC, 2005a). As discussed below in Appendix B, historical information has been compiled documenting that there have been no releases of radionuclides to the Backlands Area and that radioactivity measured there is indistinguishable from background. Therefore, radionuclides in the Backlands Area will be addressed as part of naturally occurring background. Because radionuclides are indistinguishable from background, as are chemical constituents for the majority of the Backlands Area, it is concluded that there is no cumulative risk attributable to Maine Yankee in the Backlands Area.

The cumulative risk assessment for the Backlands Area is summarized in Appendix B.

7. Conclusions

The cumulative risk assessment report was developed to satisfy the requirements in State Public Law, Chapter 739 38 MRSA Section 1455, "Nuclear Facility Decommissioning Cleanup". This law requires that the cumulative risk posed by radiological and chemical contaminants shall be evaluated at a facility undergoing decommissioning. The cumulative risk assessment provided an assessment of potential exposures and risks to combined radionuclide and chemical contaminants remaining at the Maine Yankee facility. This assessment was based on radionuclide data collected following decommissioning activities conducted in accordance with the LTP, and chemical concentration data collected as part of the RCRA closure activities. The processes used to develop the cumulative risk assessment (described in Appendix A of this report) were developed in collaboration between Maine Yankee, U.S. EPA and the state of Maine.

The results from this assessment indicate that cumulative risks were driven by the chemical constituents in soil and groundwater. On average, radionuclide risks for the residential scenario were approximately 1 percent of the cumulative risks. The cumulative risk assessment used the smallest units of analysis feasible in assessing cumulative risks to facilitate the identification of areas where institutional controls may be needed. Radionuclides in soil did not result in a significant cumulative risk across the site. In addition, Maine Yankee intends to place an institutional control on all of Bailey Point, limiting future land use to commercial/industrial activities. This control also would prohibit groundwater use on Bailey Point by preventing the installation of water supply wells within the area of contaminated groundwater. These institutional controls would be implemented through a restrictive covenant.

Risks from ingestion of shellfish caught near Maine Yankee (in offsite areas) and from reference areas well away from the facility were similar, both for chemical contaminants and radionuclides. Therefore, there are no offsite cumulative risks from shellfish consumption from either radionuclides or chemical contaminants.

Groundwater monitoring for radionuclides will continue at the Maine Yankee facility for five years. Evaluation of future groundwater data will occur through this groundwater monitoring program. The groundwater monitoring program will continue to assess trends in radionuclide concentrations, and future analysis of trends in concentrations will be presented in the annual groundwater monitoring reports for the Maine Yankee facility. It is anticipated that further assessment of groundwater risks through the cumulative risk assessment will not be required; however, the methods for assessing groundwater risks have been documented in Section 6.3.2 and Appendix F, if needed in the future. Should the trend analysis that will be presented in the annual groundwater monitoring report indicate that there is an increasing trend (over the next five years), an addendum will be prepared for the cumulative risk assessment report to update assessment of groundwater risks.

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Tables

TABLE 3-1

Exposure Unit Summary
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Exposure Unit	Exposure Unit for Chemical Risks (RFI Investigation Area)	Exposure Unit for Radionuclide Risks (Final Status Survey)					
		Survey Unit Designation	Survey Area	Survey Unit	Survey Description		
EU-1	Plant Area	SU01	FR0100	1	Yard West (2)		
		SU02	FR0100	2	Yard West (2)		
		SU03	FR0100	3	Yard West		
		SU04	FR0111	8	Soil Remediation Areas		
		SU05	FR0111	9	Soil Remediation Areas		
		SU06	FR0111	10	Soil Remediation Areas		
		SU07	FR0111	11	Soil Remediation Areas		
		SU08	FR0111	12	Soil Remediation Areas		
		SU09	FR0111	13	Soil Remediation Areas		
		SU10	FR0111	14	Soil Remediation Areas		
		SU11	FR0111	15	Soil Remediation Areas		
		SU12	FR0111	16	Soil Remediation Areas		
		SU13	FR0111	17	Soil Remediation Areas		
		SU14	FR0111	18	Soil Remediation Areas		
		SU15	FR0111	19	Soil Remediation Areas		
		SU16	FR0111	20	Soil Remediation Areas		
		SU17	FR0200	1	Yard East		
		SU18	FR0200	2	Yard East		
		SU19	FR0200	3	Yard East		
		SU20	FR0200	4	Yard East		
		SU21	FR0200	5	Yard East		
		SU22	FR0200	6	Yard East		
		SU23	FR0200	7	Yard East		
		SU24	FR0200	8	Yard East		
		SU25	FR0200	9	Yard East		
		SU30	FR0500	1	Bailey Point		
		SU31	FR0500	2	Bailey Point		
		SU34	FR0900	1	BOP Land (Land South of 345 Yard & Little Oak Is)		
		SU36	FR0900	3	BOP Land		
		SU52	FA0400	1	Fuel Building Footprint		
		EU-2	Warehouse 2/3 Area	SU34	FR0900	1	BOP Land (Land South of 345 Yard & Little Oak Is)
				SU47	FB1500	1	Warehouse 2/3
SU51	FB2600			1	Warehouse 5		
EU-3	345 kV Transmission Line Area	SU40	FR1800	1	Bailey Land		
		SU41	FR1800	2	Bailey Land		
		SU43	FR2900	1	Final Grade, Rails, Roads: East Plant Access Road & adjoining parking lots and roads		
		SU44	FR2900	2	Final Grade, Rails, Roads: West Access Rd & adjoining parking lots and roads		
		SU45	FR2900	3	Final Grade, Rails, Roads (south & west) & Staff Bld Parking Lot, Lots E,C		

TABLE 3-1
 Exposure Unit Summary
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Exposure Unit	Exposure Unit for Chemical Risks (RFI Investigation Area)	Exposure Unit for Radionuclide Risks (Final Status Survey)			
		Survey Unit Designation	Survey Area	Survey Unit	Survey Description
EU-4	Bailey House Area	SU40	FR1800	1	Bailey Land
		SU41	FR1800	2	Bailey Land
		SU42	FR1800	3	Bailey Land
		SU43	FR2900	1	Final Grade, Rails, Roads: East Plant Access Road & adjoining parking lots and roads
		SU49	FB1900	1	Bailey House Footprint
		SU50	FB2000	1	Bailey Barn Footprint
EU-5	Former Maintenance Truck Garage	SU40	FR1800	1	Bailey Land
EU-6	Parking Lot Area	SU32	FR0800	1	Admin and Parking Areas
		SU33	FR0810	1	Collection Site Sub Slab
		SU34	FR0900	1	BOP Land (Land South of 345 Yard & Little Oak Is)
		SU35	FR0900	2	BOP Land
		SU37	FR0900	4	BOP Land
		SU38	FR0910	1	Fire Pond
		SU41	FR1800	2	Bailey Land
		SU43	FR2900	1	Final Grade, Rails, Roads: East Plant Access Road & adjoining parking lots and roads
		SU44	FR2900	2	Final Grade, Rails, Roads: West Access Rd & adjoining parking lots and roads
		SU45	FR2900	3	Final Grade, Rails, Roads (south & west) & Staff Bld Parking Lot, Lots E,C
EU-7	Foxbird Island	SU39	FR1000	0	Foxbird Island
EU-8	Forebay	SU03	FR0100	3	Yard West
		SU26	FR0400	1	Forebay Seal Pit Floor
		SU27	FR0400	2	Forebay Seal Pit Slopes
		SU39	FR1000	0	Foxbird Island

TABLE 4-1

Summary of Carcinogenic Chemicals of Potential Concern Present in Contaminated Media
Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Exposure Medium	Chemical Class	Carcinogenic COPCs
Soil	Metals	Arsenic
	PCBs	Total PCBs
	SVOCs	Benzo(a)pyrene -equivalent (cPAHs)
Sediment	Metals	Arsenic
	SVOCs	Benzo(a)pyrene -equivalent (cPAHs)
Shellfish	Metals	Arsenic
	PCBs	Total PCBs Total PCBs (Arochlor 1260 only)
	Pesticides	Alpha-Hexachlorocyclohexane 4,4'-DDE Dieldrin
	SVOCs	Benzo(a)pyrene -equivalent (cPAHs)
Groundwater	Metals	Arsenic
	Pesticides	Dieldrin Heptachlor
	SVOCs	Bis(2-ethylhexyl)phthalate
	VOCs	1,2-Dichloroethane Benzene Bromodichloromethane Trichloroethene Vinyl chloride

TABLE 4-2

Summary of Constituents Of Potential Concern in Soil¹

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Exposure Unit 1 - Plant Area							
Medium	Chemical	Minimum Conc. (mg/kg)	Maximum Conc. (mg/kg)	Location of Maximum	Detection Frequency	Average Concentration	95% UCL Concentration
Surface Soils							
	ARSENIC	4.6	22.3 J	MY05SB57(0-0.5)	39/39	7.7	8.6
	BENZO(A)PYRENE equivalent		22823				
	BENZO(A)ANTHRACENE	100 J	19000	MY05SS80 & SS95(0-0.5)	29/47	1779	
	BENZO(A)PYRENE	85 J	16000	MY05SS80 & SS95(0-0.5)	28/47	1632	
	BENZO(B)FLUORANTHENE	95 J	21000	MY05SS80 & SS95(0-0.5)	29/47	2030	
	BENZO(K)FLUORANTHENE	81 J	8400 J	MY05SS80 & SS95(0-0.5)	24/47	923	
	DIBENZO(A,H)ANTHRACENE	280 J	1750	MY05SS80 & SS95(0-0.5)	10/47	413	
	CHRYSENE	120 J	19000	MY05SS80 & SS95(0-0.5)	29/47	1737	
	INDENO(1,2,3-CD)PYRENE	190 J	9700	MY05SS80 & SS95(0-0.5)	22/47	1150	
Surface and Subsurface Soils							
	ARSENIC	2	22.3	MY05SB57(0-0.5)	52/53	7.7	8.6
	BENZO(A)PYRENE equivalent		22823				
	BENZO(A)ANTHRACENE	100	19000	MY05SS80 & SS95(0-0.5)	32/61	1446	
	BENZO(A)PYRENE	85	16000	MY05SS80 & SS95(0-0.5)	31/61	1327	
	BENZO(B)FLUORANTHENE	95	21000	MY05SS80 & SS95(0-0.5)	32/61	1634	
	CHRYSENE	110	19000	MY05SS80 & SS95(0-0.5)	32/61	1408	
	DIBENZO(A,H)ANTHRACENE	280	1750	MY05SS80 & SS95(0-0.5)	11/61	347	
	BENZO(K)FLUORANTHENE	81	8400	MY05SS80 & SS95(0-0.5)	27/61	768	
	INDENO(1,2,3-CD)PYRENE	190	9700	MY05SS80 & SS95(0-0.5)	24/61	941	

TABLE 4-2

Summary of Constituents Of Potential Concern in Soil¹

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Exposure Unit 2 - Warehouse 2/3							
Medium	Chemical	Min Conc.	Max Conc.	Location of Maximum	Detection Frequency	Average Conc.	95% UCL Conc.
Surface Soils							
	ARSENIC	2.1	16.6	MY05TP01(0-0.5)	8/8	9.3	13
	Total PCBs		2000				
	PCB-1254	1400	1400	MY05TP01(0-0.5)	1/16	96	266
	PCB-1260	150 J	600 J	MY05HA09(0-0.5)	3/16	82	169
	BENZO(A)PYRENE equivalent		5038.6				
	BENZO(A)ANTHRACENE	220 J	4200	MY05SS101	4/12	937	1728
	BENZO(A)PYRENE	200 J	3400	MY05SS101	4/12	777	1403
	BENZO(B)FLUORANTHENE	330 J	5300	MY05SS101	4/12	1188	2226
	BENZO(K)FLUORANTHENE	1000	2400	MY05SS101	3/12	543	943
	CHRYSENE	255 J	4600	MY05SS101	4/12	998	1856
	DIBENZO(A,H)ANTHRACENE	250 J	430	MY05SS101	3/12	223	264
	INDENO(1,2,3-CD)PYRENE	1100	2300	MY05SS101	3/12	559	964
Surface and Subsurface Soils							
	ARSENIC	2.1	16.8	MY05TP01(3-3.5)	19/19	8.7	11
	Total PCBs		2000				
	PCB-1254	52	1400	MY05TP01(0-0.5)	4/35	68	148
	PCB-1260	31 J	600 J	MY05HA09(0-0.5)	4/35	43	84
	BENZO(A)PYRENE equivalent		5039				
	BENZO(A)ANTHRACENE	220 J	4200	MY05SS101	4/39	423	683
	BENZO(A)PYRENE	200 J	3400	MY05SS101	4/39	374	579
	BENZO(B)FLUORANTHENE	180 J	5300	MY05SS101	5/39	500	843
	BENZO(K)FLUORANTHENE	1000	2400	MY05SS101	3/39	302	432
	CHRYSENE	255 J	4600	MY05SS101	4/39	442	724
	DIBENZO(A,H)ANTHRACENE	250 J	430	MY05SS101	3/39	203	217
	INDENO(1,2,3-CD)PYRENE	1100	2300	MY05SS101	3/39	307	439

TABLE 4-2

Summary of Constituents Of Potential Concern in Soil¹

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Exposure Unit 3 - 345 kV Transmission Line Area							
Medium	Chemical	Minimum Conc.	Maximum Conc.	Location of Maximum	Detection Frequency	Conc. Used for Screening	95% UCL Concentration
Surface Soils							
	ARSENIC	3.5	15.1	MY05SS109(0-0.5)	26/26	15.1	11
	BENZO(A)PYRENE equivalent		1128.5				
	BENZO(A)ANTHRACENE	207.5	1100	MY05SS12(0-0.5)	2/25	1100	304
	BENZO(A)PYRENE	217.5	860	MY05SS12(0-0.5)	2/25	860	277
	BENZO(B)FLUORANTHENE	202.5	1100	MY05SS12(0-0.5)	2/25	1100	304
	BENZO(K)FLUORANTHENE	350	350	MY05SS12(0-0.5)	1/25	350	219
	CHRYSENE	212.5	1000	MY05SS12(0-0.5)	2/25	1000	293
	INDENO(1,2,3-CD)PYRENE	440	440	MY05SS12(0-0.5)	1/25	440	229
Surface and Subsurface Soils							
	ARSENIC	3.5	16.2	MY05SB46(4-6)	49/49	16.2	12
	BENZO(A)PYRENE equivalent		1557				
	BENZO(A)ANTHRACENE	207.5	1100	MY05SS12(0-0.5)	4/48	1100	261
	BENZO(A)PYRENE	217.5	860	MY05SS12(0-0.5)	5/48	860	267
	BENZO(B)FLUORANTHENE	202.5	1100	MY05SS12(0-0.5)	5/48	1100	284
	BENZO(K)FLUORANTHENE	350	560	MY05TP107A(9-11)	4/48	560	239
	CHRYSENE	212.5	1000	MY05SS12(0-0.5)	3/48	1000	254
	DIBENZO(A,H)ANTHRACENE	420	420	MY05TP111A(9-11)	1/48	420	216
	INDENO(1,2,3-CD)PYRENE	360	560	MY05TP107A(9-11)	4/48	560	241
Exposure Unit 4 - Bailey Farmhouse							
Medium	Chemical	Minimum Conc.	Maximum Conc.	Location of Maximum	Detection Frequency	Conc. Used for Screening	95% UCL Conc.
Surface Soils							
	ARSENIC	7.2	7.2	MY05SB25(0-0.5)	1/1	7.2	NA
Surface and Subsurface Soils							
	ARSENIC	6.4	8.2	MY05SB25(2-8)	3/3	8.2	8.3

Note:

1. Those COPCs exceeding 1×10^{-6} cancer risk
 Data from Tables 5-1C through 5-1F, MYAPC, 2004.

TABLE 4-3

Summary of Constituents Of Potential Concern in Groundwater¹

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Chemical	Minimum Conc. (ug/L)	Maximum Conc. (ug/L)	Location of Maximum (Monitoring Well)	Frequency of Detection	Average Concentration	Survey Unit	Exposure Unit
ARSENIC	0.01 J	23.3	MY05GW106-1C (MW-404)	31/97	6.60	SU37	EU-1 Plant Area
DIELDRIN	0.057	0.1 J	MY05GW101 (MW-401)	5/55	0.09	SU05	EU-1 Plant Area
HEPTACHLOR	0.52	0.52	MY05GW17 (MW-315)	1/55	0.52	SU40	EU-1/EU-4 Plant Area/Bailey House Area
BIS(2-ETHYLHEXYL)PHTHALATE	7 J	7 J	MY05GW21 (MW-321)	1/61	7.00	SU41	EU-1/EU-3 Plant Area/345 kV Transmission Line Area
1,2-DICHLOROETHANE	2	2	MY05GW113-1C (MW-409A)	1/77	2.00	SU31	EU-1 Plant Area
BENZENE	0.6 J	3.7	MY05GW100 (PAB Test Pit)	4/76	1.48	SU11	EU-1 Plant Area
BROMODICHLOROMETHANE	2	2	MY05GW123 (MW-422B)	1/77	2.00	SU31	EU-1 Plant Area
TRICHLOROETHENE	1	4	MY05GW129 (MW-423B)	2/76	2.50	SU31	EU-1 Plant Area
VINYL CHLORIDE	0.13 J	2 J	MY05GW113, MY05GW113-1C (MW-409A)	8/77	0.69	SU31	EU-1 Plant Area

Note:

1. Those COPCs exceeding 1×10^{-6} cancer risk

Data from Table 5-1J, MYAPC, 2005

TABLE 4-4

Summary of Constituents Of Potential Concern in Sediments¹*Cumulative Risk Assessment**Maine Yankee Facility, Wiscasset, ME*

Chemical	Min. Conc. (mg/kg)	Max Conc. (mg/kg)	Location of Maximum	Detection Frequency	Average Concentration	95% UCL Concentration
ARSENIC	2.9	15.6	MY06SD05	33/33	7.72	8.79
BENZO(A)PYRENE equivalent		17041				3639
<i>BENZO(A)ANTHRACENE</i>	47	14000 J	MY06SD16A	61/64	1857	2630
<i>BENZO(A)PYRENE</i>	24	10000	MY06SD101A(0-3.5)	61/64	1576	2210
<i>BENZO(B)FLUORANTHENE</i>	28	14000	MY06SD101A(0-3.5)	61/64	2016	2830
<i>BENZO(K)FLUORANTHENE</i>	12 J	5100	MY06SD101A(0-3.5)	61/64	806	1100
<i>CHRYSENE</i>	32 J	12000	MY06SD101A(0-3.5)	62/65	1725	2000
<i>DIBENZO(A,H)ANTHRACENE</i>	3 J	3400	MY06SD101A(0-3.5), MY06SD101B(0-3.5)	37/64	509	729
<i>INDENO(1,2,3-CD)PYRENE</i>	17 J	6700	MY06SD101A(0-3.5)	60/63	1004	1410

Note:

1. Those COPCs exceeding 1×10^{-6} cancer risk

Data from Table 5-1H, MYAPC, 2004

PAHs making up the Benzo(a)pyrene equivalent (in italics) are not necessarily the risk drivers. Their data is included in order to present concentrations.

TABLE 4-5

Summary of Constituents Of Potential Concern in Shellfish Tissue¹

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Medium	Chemical	Min Conc. (mg/kg)	Max Conc. (mg/kg)	Units	Location of Maximum	Detection Frequency	Average Conc.	95% UCL Conc.
Tissue/Mussel								
	ARSENIC	0.72	1.39	mg/kg	MY06BM03	14/14	1.123	1.223
	BENZO(A)PYRENE equivalent		8.8	ug/kg				
	<i>BENZO(A)ANTHRACENE</i>	1 J	6.7	ug/kg	BM01&BM04	14/14	1.614	2.013
	<i>BENZO(A)PYRENE</i>	0.6 J	6	ug/kg	BM01&BM04	14/14	1.074	1.454
	<i>BENZO(B)FLUORANTHENE</i>	1.8	9.5	ug/kg	BM01&BM04	14/14	2.789	3.359
	<i>BENZO(K)FLUORANTHENE</i>	0.58 J	3.2	ug/kg	BM01&BM04	14/14	0.971	1.168
	<i>CHRYSENE</i>	1.6 J	8.5	ug/kg	BM01&BM04	14/14	2.439	2.922
	<i>DIBENZO(A,H)ANTHRACENE</i>	0.087 J	0.7	ug/kg	BM01&BM04	14/14	0.144	0.189
	<i>INDENO(1,2,3-CD)PYRENE</i>	0.53 J	4.2	ug/kg	BM01&BM04	14/14	0.902	1.160
Tissue/Clams								
	ARSENIC	1.21	7.11	mg/kg	MY06BC01	18/18	2.817	3.52
	Total PCBs		6.4					4.83
	PCB 1254	0.975 J	3 J	ug/kg	MY06BC02	18/18	2.065	2.37
	PCB 1260	1.1 J	3.4	ug/kg	MY06BC03	18/18	2.169	2.46
	BENZO(A)PYRENE equivalent		5.1	ug/kg				3.48
	<i>BENZO(A)ANTHRACENE</i>	1 J	3.7	ug/kg	MY06BC11	18/18	2.184	2.55
	<i>BENZO(A)PYRENE</i>	0.88 J	3.5	ug/kg	MY06BC04	18/18	1.992	2.33
	<i>BENZO(B)FLUORANTHENE</i>	1.6 J	6	ug/kg	MY06BC04	18/18	3.622	4.23
	<i>BENZO(K)FLUORANTHENE</i>	0.68 J	2.1 J	ug/kg	MY06BC11	18/18	1.309	1.51
	<i>CHRYSENE</i>	1.5 J	5.1	ug/kg	MY06BC11	17/17	2.942	3.49
	<i>DIBENZO(A,H)ANTHRACENE</i>	0.11 J	0.37 J	ug/kg	MY06BC04, BC1	18/18	0.228	0.26
	<i>INDENO(1,2,3-CD)PYRENE</i>	0.66 J	2.7	ug/kg	MY06BC04	18/18	1.558	1.83
Tissue/Lobster								
	ARSENIC	2.66	2.82	mg/kg	MY06BL02	4/4	2.74	2.810

TABLE 4-5

Summary of Constituents Of Potential Concern in Shellfish Tissue¹*Cumulative Risk Assessment**Maine Yankee Facility, Wiscasset, ME*

Medium	Chemical	Min Conc. (mg/kg)	Max Conc. (mg/kg)	Units	Location of Maximum	Detection Frequency	Average Conc.	95% UCL Conc.
Tissue/Lobster/Tomalley								
	ARSENIC	4.29	4.29	mg/kg	MY06BL06	1/1	NA	NA
	Total PCBs (Aroclor 1260 only)	130 J	130 J	ug/kg	MY06BL06	1/1	NA	NA
	4,4'-DDE	38 J	38 J	ug/kg	MY06BL06	1/1	NA	NA
	ALPHA-HEXACHLOROCYCLOHEXANE	1.1 J	1.1 J	ug/kg	MY06BL06	1/1	NA	NA
	DIELDRIN	2.6 J	2.6 J	ug/kg	MY06BL06	1/1	NA	NA
	BENZO(A)PYRENE equivalent		4.9	ug/kg				
	<i>BENZO(A)ANTHRACENE</i>	5.6 J	5.6 J	ug/kg	MY06BL06	1/1	NA	NA
	<i>BENZO(A)PYRENE</i>	2.7 J	2.7 J	ug/kg	MY06BL06	1/1	NA	NA
	<i>BENZO(B)FLUORANTHENE</i>	8.8 J	8.8 J	ug/kg	MY06BL06	1/1	NA	NA
	<i>BENZO(K)FLUORANTHENE</i>	2.7 J	2.7 J	ug/kg	MY06BL06	1/1	NA	NA
	<i>CHRYSENE</i>	20 J	20 J	ug/kg	MY06BL06	1/1	NA	NA
	<i>DIBENZO(A,H)ANTHRACENE</i>	0.49 J	0.49 J	ug/kg	MY06BL06	1/1	NA	NA
	<i>INDENO(1,2,3-CD)PYRENE</i>	2.6 J	2.6 J	ug/kg	MY06BL06	1/1	NA	NA

TABLE 4-5

Summary of Constituents Of Potential Concern in Shellfish Tissue¹

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Medium	Chemical	Min Conc. (mg/kg)	Max Conc. (mg/kg)	Units	Location of Maximum	Detection Frequency	Average Conc.	95% UCL Conc.
Tissue/Clams - Reference Locations								
	ARSENIC	2.84	3.42	mg/kg	MYRSB-C02	3/3	3.187	NA
	Total PCBs		8.6	ug/kg			7.660	
	PCB 1254	3.4	4.6	ug/kg	MYRSB-C02	3/3	3.967	NA
	PCB 1260	3.3 J	4	ug/kg	MYRSB-C02	3/3	3.700	NA
	BENZO(A)PYRENE equivalent		6.0	ug/kg			5.669	
	<i>BENZO(A)ANTHRACENE</i>	3.3	4	ug/kg	MYRSB-C03	3/3	3.633	NA
	<i>BENZO(A)PYRENE</i>	3.6	4.1	ug/kg	MYRSB-C03	3/3	3.867	NA
	<i>BENZO(B)FLUORANTHENE</i>	5.8 J	7.1 J	ug/kg	MYRSB-C03	3/3	6.500	NA
	<i>DIBENZO(A,H)ANTHRACENE</i>	0.46 J	0.5 J	ug/kg	MYRSB-C03	3/3	0.480	NA
	<i>CHRYSENE</i>	4.5	6.2	ug/kg	MYRSB-C03	3/3	5.267	NA
	<i>INDENO(1,2,3-CD)PYRENE</i>	2.8	3.2	ug/kg	MYRSB-C03	3/3	3.033	NA
Tissue/Mussels - Reference Locations								
	ARSENIC	0.98	1.53	mg/kg	MYRSB-M02	4/4	1.370	NA
	BENZO(A)PYRENE equivalent		2.9	ug/kg			2.614	
	<i>BENZO(A)ANTHRACENE</i>	1.6	2.6	ug/kg	MYRSB-M03	4/4	2.250	NA
	<i>BENZO(A)PYRENE</i>	1.1 J	1.7	ug/kg	MYRSB-M03	4/4	1.550	NA
	<i>BENZO(B)FLUORANTHENE</i>	3.1	5.2	ug/kg	MYRSB-M03	4/4	4.475	NA
	<i>BENZO(K)FLUORANTHENE</i>	1	1.6 J	ug/kg	MYRSB-M03	4/4	1.400	NA
	<i>DIBENZO(A,H)ANTHRACENE</i>	0.18 J	0.27 J	ug/kg	MYRSB-M03	4/4	0.240	NA
	<i>CHRYSENE</i>	2.3	4	ug/kg	MYRSB-M02	4/4	3.350	NA
	<i>INDENO(1,2,3-CD)PYRENE</i>	0.96 J	1.5 J	ug/kg	MYRSB-M02	4/4	1.340	NA

Note:

1. Those COPCs exceeding 1×10^{-6} cancer risk

Data from Table 5-11, MYAPC, 2004

TABLE 4-6
 Summary of Nuclides Potentially Present in Contaminated Media
Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Contaminated Media	Nuclides Present	Source
Contaminated concrete surfaces	H-3, Fe-55, Co-57, Co-60, Ni-63, Sr-90, Cs-134, Cs-137	Table 2-7, LTP (MYPAC, 2005a)
Contaminated concrete trenches (containment floor)	Co-60, Mn-54, Fe-55, Ni-63, Sr-90, Sb-125, Cs-134, Cs-137, Pu-238, Pu-239/240, Pu-241, Am-241, Cm-243/244	Table 2-8, LTP (MYAPC, 2005a)
Activated concrete and rebar	H-3, C-14, Fe-55, Ni-63, Co-60, Cs-134, Eu-152, Eu-154	Table 2-9, LTP (MYAPC 2005a)
Soil	Cs-137, H-3, Ni-63, Co-60	Table 2-11, LTP (MYAPC, 2005a)
Ground water and surface water	H-3	Table 2-12, LTP (MYAPC, 2005a)
Forebay sediment	Fe-55, Ni-63, Co-60, Sb-125, Cs-137	Table 2-13, LTP (MYAPC, 2005a)

Note:

Nuclides listed in this table were evaluated to identify contaminants of potential concern addressed in the cumulative risk assessment.

TABLE 4-7

Annual Dose Contributions from Contaminated Material

*Cumulative Risk Assessment**Maine Yankee Facility, Wiscasset, ME*

Material	Drinking Water Dose (mrem/y)	Direct, Inhalation, & Ingestion Dose (mrem/y)	Combined Annual Dose (mrem/y)	% of Total Dose
Surface Soil	0.00E+00	7.52E+00	7.52E+00	77
Deep Soil	3.97E-02	1.48E+00	1.52E+00	16
Contaminated Concrete	2.70E-01	3.08E-02	3.01E-01	3.1
Ground Water	2.08E-01	0.00E+00	2.08E-01	2.1
Spray Building Pump Embedded Piping	7.60E-02	8.67E-03	8.47E-02	0.87
BOP Embedded Piping	4.59E-02	5.23E-03	5.11E-02	0.52
Activated Concrete	1.05E-02	3.02E-02	4.08E-02	0.42
Surface Water	2.94E-02	1.27E-03	3.06E-02	0.31
Buried Piping, Conduit & Cable	6.33E-04	1.89E-03	2.52E-03	0.026
Total	0.68	9.08	9.76	100

Modified from Table 6-11 in the LTP.

Material (For Containment Building)	Drinking Water Dose (mrem/y)	Direct, Inhalation, & Ingestion Dose (mrem/y)	Combined Annual Dose (mrem/y)	% of Total Dose
Surface Soil	0.00E+00	5.63E+00	5.63E+00	68.91
Deep Soil	5.66E-02	1.98E+00	2.04E+00	24.97
Contaminated Concrete	7.32E-02	8.35E-03	8.15E-02	1.00
Ground Water	2.08E-01	0.00E+00	2.08E-01	2.55
Spray Building Pump Embedded Piping	7.60E-02	8.67E-03	8.47E-02	1.04
BOP Embedded Piping	4.59E-02	5.23E-03	5.11E-02	0.63
Activated Concrete	1.36E-02	3.30E-02	4.66E-02	0.57
Surface Water	2.94E-02	1.27E-03	3.06E-02	0.37
Buried Piping, Conduit & Cable	6.33E-04	1.89E-03	2.52E-03	0.03
Total	0.50	7.67	8.17	100

Material (For Non-Containment Buildings)	Drinking Water Dose (mrem/y)	Direct, Inhalation, & Ingestion Dose (mrem/y)	Combined Annual Dose (mrem/y)	% of Total Dose
Surface Soil	0.00E+00	5.63E+00	5.63E+00	67.51
Deep Soil	5.33E-02	1.98E+00	2.04E+00	24.46
Contaminated Concrete	2.70E-01	3.08E-02	3.01E-01	3.61
Ground Water	2.08E-01	0.00E+00	2.08E-01	2.49
Spray Building Pump Embedded Piping	7.60E-02	8.67E-03	8.47E-02	1.02
BOP Embedded Piping	4.59E-02	5.23E-03	5.11E-02	0.61
Activated Concrete	0.00E+00	0.00E+00	0.00E+00	0.00
Surface Water	2.94E-02	1.27E-03	3.06E-02	0.37
Buried Piping, Conduit & Cable	6.33E-04	1.89E-03	2.52E-03	0.03
Total	0.68	7.66	8.34	100

TABLE 4-8

Contributions to Annual Dose from Surface Soil

*Cumulative Risk Assessment**Maine Yankee Facility, Wiscasset, ME*

Nuclide	NUREG-1727 (mrem/y per pCi/g)	Nuclide Fraction	Concentration in Soil (pCi/g)	Total Dose (mrem/y)	% of Total Dose
Cs-137	2.27E+00	8.90E-01	3.20E+00	7.26E+00	97
Co-60	6.58E+00	9.00E-03	3.24E-02	2.13E-01	2.8
H-3	2.27E-01	5.30E-02	1.91E-01	4.33E-02	0.58
Ni-63	1.19E-02	4.80E-02	1.73E-01	2.05E-03	0.027
Total		1.00E+00	3.60E+00	7.52E+00	100

Modified from Attachment 6-13, page 5 of 12 in the LTP.

Nuclide	NUREG-1727 (mrem/y per pCi/g)	Nuclide Fraction	Concentration in Soil (pCi/g)	Total Dose (mrem/y)	% of Total Dose
Cs-137	2.27E+00	8.90E-01	2.39E+00	5.43E+00	96
Co-60	6.58E+00	9.00E-03	2.42E-02	1.59E-01	2.8
H-3	2.27E-01	5.30E-02	1.43E-01	3.24E-02	0.6
Ni-63	1.19E-02	4.80E-02	1.29E-01	1.54E-03	0.0
Total		1.00E+00	2.69E+00	5.63E+00	100

TABLE 4-9
 Statistics and Concentrations of Radionuclides - Soil
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Exposure Unit - RFI Investigation Area	Survey Unit Designation	Survey Area	Survey Unit	Survey Description	Mean Activity (pCi/g)		Number of Samples	Standard Deviation		Activity Corrected for Background (pCi/g)		Source Concentration in Soil for Risk Assessment (pCi/g)	
					Cs-137	Co-60		Cs-137	Co-60	Cs-137	Co-60	Cs-137	Co-60
EU-1 Plant Area	SU01	FR0100	1	Yard West (2)	8.46E-02	0	40	1.01E-01	0	-1.05E-01	0	0	0
	SU02	FR0100	2	Yard West (2)	7.96E-02	5.08E-02	154	5.48E-02	1.52E-02	-1.10E-01	5.08E-02	0	5.08E-02
	SU03	FR0100	3	Yard West	9.70E-02	0	43	1.71E-01	0	-9.30E-02	0	0	0
	SU04	FR0111	8	Soil Remediation Areas	9.47E-02	0	40	1.34E-01	0	-9.53E-02	0	0	0
	SU05	FR0111	9	Soil Remediation Areas	7.68E-02	5.78E-02	43	5.22E-02	1.47E-02	-1.13E-01	5.78E-02	0	5.78E-02
	SU06	FR0111	10	Soil Remediation Areas	8.00E-02	7.18E-02	42	8.02E-02	8.35E-02	-1.10E-01	7.18E-02	0	7.18E-02
	SU07	FR0111	11	Soil Remediation Areas	1.20E-01	6.54E-02	40	1.15E-01	4.08E-02	-7.00E-02	6.54E-02	0	6.54E-02
	SU08	FR0111	12	Soil Remediation Areas	7.91E-02	6.05E-02	40	7.25E-02	2.44E-02	-1.11E-01	6.05E-02	0	6.05E-02
	SU09	FR0111	13	Soil Remediation Areas	6.69E-02	0	40	1.53E-01	0	-1.23E-01	0	0	0
	SU10	FR0111	14	Soil Remediation Areas	5.30E-02	5.23E-02	41	2.58E-02	2.45E-02	-1.37E-01	5.23E-02	0	5.23E-02
	SU11	FR0111	15	Soil Remediation Areas	6.04E-02	5.99E-02	42	1.89E-02	2.52E-02	-1.30E-01	5.99E-02	0	5.99E-02
	SU12	FR0111	16	Soil Remediation Areas	1.22E-01	7.92E-02	42	2.43E-01	7.97E-02	-6.80E-02	7.92E-02	0	7.92E-02
	SU13	FR0111	17	Soil Remediation Areas	8.21E-02	5.48E-02	40	1.29E-01	9.87E-03	-1.08E-01	5.48E-02	0	5.48E-02
	SU14	FR0111	18	Soil Remediation Areas	4.73E-02	0	40	1.22E-02	0	-1.43E-01	0	0	0
	SU15	FR0111	19	Soil Remediation Areas	6.30E-02	0	40	4.82E-02	0	-1.27E-01	0	0	0
	SU16	FR0111	20	Soil Remediation Areas	6.78E-02	8.66E-02	40	5.10E-02	2.13E-01	-1.22E-01	8.66E-02	0	8.66E-02
	SU17	FR0200	1	Yard East	9.69E-02	0	14	1.40E-01	0	-9.31E-02	0	0	0
	SU18	FR0200	2	Yard East	5.76E-02	0	14	1.62E-02	0	-1.32E-01	0	0	0
	SU19	FR0200	3	Yard East	5.12E-02	0	42	1.31E-02	0	-1.39E-01	0	0	0
	SU20	FR0200	4	Yard East	5.11E-02	5.43E-02	42	2.60E-02	2.03E-02	-1.39E-01	5.43E-02	0	5.43E-02
	SU21	FR0200	5	Yard East	5.19E-02	6.39E-02	52	1.89E-02	5.47E-02	-1.38E-01	6.39E-02	0	6.39E-02
	SU22	FR0200	6	Yard East	5.86E-02	5.93E-02	40	2.99E-02	2.76E-02	-1.31E-01	5.93E-02	0	5.93E-02
	SU23	FR0200	7	Yard East	5.80E-02	6.76E-02	42	3.21E-02	6.02E-02	-1.32E-01	6.76E-02	0	6.76E-02
	SU24	FR0200	8	Yard East	4.78E-02	5.49E-02	48	1.23E-02	2.54E-02	-1.42E-01	5.49E-02	0	5.49E-02
	SU25	FR0200	9	Yard East	6.53E-02	7.76E-02	45	5.56E-02	7.34E-02	-1.25E-01	7.76E-02	0	7.76E-02
SU30	FR0500	1	Bailey Point	6.56E-02	0	16	2.71E-02	0	-1.24E-01	0	0	0	
SU31	FR0500	2	Bailey Point	4.16E-01	0	14	5.01E-01	0	2.26E-01	0	2.26E-01	0	
SU34	FR0900	1	BOP Land (Land South of 345 Yard & Little Oak Is)	2.03E-01	0	19	3.96E-01	0	1.30E-02	0	1.30E-02	0	
SU36	FR0900	3	BOP Land	3.57E-01	0	19	3.18E-01	0	1.67E-01	0	1.67E-01	0	
SU52	FA0400	1	Fuel Building Footprint	1.82E-01	1.33E-01	50	2.52E-01	1.97E-01	-8.00E-03	1.33E-01	0	1.33E-01	
EU-2 Warehouse 2/3	SU34	FR0900	1	BOP Land (Land South of 345 Yard & Little Oak Is)	2.03E-01	0	19	3.96E-01	0	1.30E-02	0	1.30E-02	0
	SU47	FB1500	1	Warehouse 2/3	4.26E-02	0	14	5.51E-03	0	-1.47E-01	0	0	0
	SU51	FB2600	1	Warehouse 5	2.72E-02	0	14	7.90E-03	0	-1.63E-01	0	0	0

TABLE 4-9
 Statistics and Concentrations of Radionuclides - Soil
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Exposure Unit - RFI Investigation Area	Survey Unit Designation	Survey Area	Survey Unit	Survey Description	Mean Activity (pCi/g)		Number of Samples	Standard Deviation		Activity Corrected for Background (pCi/g)		Source Concentration in Soil for Risk Assessment (pCi/g)	
					Cs-137	Co-60		Cs-137	Co-60	Cs-137	Co-60	Cs-137	Co-60
EU-3 345 kV Transmission Line Area	SU40	FR1800	1	Bailey Land	1.08E-01	0	15	7.79E-02	0	-8.20E-02	0	0	0
	SU41	FR1800	2	Bailey Land	2.31E-01	0	15	2.22E-01	0	4.10E-02	0	4.10E-02	0
	SU42	FR1800	3	Bailey Land	1.18E-01	0	16	3.50E-02	0	-7.20E-02	0	0	0
	SU43	FR2900	1	Final Grade, Rails, Roads: East Plant Access Road & adjoining parking lots and roads	4.67E-02	0	14	3.32E-03	0	-1.43E-01	0	0	0
	SU44	FR2900	2	Final Grade, Rails, Roads: West Access Rd & adjoining parking lots and roads	5.79E-02	4.20E-02	14	8.92E-02	6.34E-02	-1.32E-01	4.20E-02	0	4.20E-02
	SU45	FR2900	3	Final Grade, Rails, Roads (south & west) & Staff Bld Parking Lot, Lots E,C	5.43E-02	0	14	5.50E-03	0	-1.36E-01	0	0	0
EU-4 Bailey Farmhouse Area	SU40	FR1800	1	Bailey Land	1.08E-01	0	15	7.79E-02	0	-8.20E-02	0	0	0
	SU41	FR1800	2	Bailey Land	2.31E-01	0	15	2.22E-01	0	4.10E-02	0	4.10E-02	0
	SU42	FR1800	3	Bailey Land	1.18E-01	0	16	3.50E-02	0	-7.20E-02	0	0	0
	SU43	FR2900	1	Final Grade, Rails, Roads: East Plant Access Road & adjoining parking lots and roads	4.67E-02	0	14	3.32E-03	0	-1.43E-01	0	0	0
	SU50	FB2000	1	Bailey Barn Footprint	2.40E-02	0	14	4.33E-03	0	-1.66E-01	0	0	0

Notes:

Survey resulting in the highest of the average concentrations measured within the survey area was used to provide the exposure point concentrations in the risk assessment.

Activities that are zero are either not detected or below background levels are treated as "zero" for purposes of evaluating cumulative risks.

Background level of Cs-137 developed from survey of Background Reference Area, FR9800

Activity Adjustments
Cs-137 Bkg (pCi/g) 1.90E-01

TABLE 4-10

Statistics and Concentrations of Radionuclides - Groundwater

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Constituent	Activity (pCi/L) in Groundwater											
	2005 - 1st Period				2006 - 1st Period				2006 - 2nd Period			
	Min	Max	Mean	Std Dev.	Min	Max	Mean	Std Dev.	Min	Max	Mean	Std Dev.
Gam/H3												
H-3	295	329	324.73	8.311	323	329	324.75	1.571	140	248	224.75	23.795
Mn-54	2.4	3.92	3.03	0.447	2.38	6.16	3.13	0.874	2.47	3.29	2.84	0.245
Co-57	1.84	3.21	2.49	0.419	1.87	5.24	2.51	0.788	1.99	2.86	2.42	0.333
Fe-59	7.39	12.3	9.16	1.488	9.14	27.3	13.48	4.206	6.4	9.6	7.88	1.041
Co-60	2.42	3.78	3.09	0.357	2.06	6.61	3.05	1.027	2.46	3.53	2.95	0.363
Zn-65	5.35	8.15	6.53	0.825	5.07	14.3	6.84	2.113	5.31	7.77	6.30	0.808
Nb-94	2.3	3.6	2.89	0.372	2.1	5.38	2.78	0.745	1.85	3.18	2.65	0.337
Zr-95	5.49	8.58	6.86	0.857	5.45	20	8.80	3.243	5.28	6.89	6.02	0.548
Ag-110m	3.54	5.11	4.18	0.469	3.46	9.13	4.42	1.347	3.45	4.65	3.94	0.435
Sb-125	6.63	9.47	7.87	0.844	5.97	15.8	7.64	2.240	6.76	7.87	7.35	0.338
Cs-134	2.45	3.51	2.81	0.287	2.22	5.89	2.81	0.843	2.39	3.02	2.67	0.166
Cs-137	2.44	3.81	3.05	0.396	2.23	5.79	2.93	0.813	2.51	3.27	2.84	0.247
Ce-141	6.44	10.3	8.21	1.191	10.7	32.1	13.99	5.023	5.93	8.19	7.12	0.858
Ce-144	14.6	23.9	19.04	3.048	15	39.1	19.13	5.731	15	21.6	18.43	2.377
Eu-152	11.6	17.8	14.84	1.825	10.6	27.5	14.42	3.759	12.8	16.4	14.39	1.178
Eu-154	6.84	10	8.53	0.952	6.32	16.7	8.37	2.365	6.95	9.76	8.05	0.920
HTD's												
C-14	16.5	16.6	16.55	0.071	43.8	43.8	0.00		NA	NA		
Fe-55	0.755	0.857	0.81	0.072	0.649	0.649	0.65		NA	NA		
Ni-59	5.22	6.27	5.75	0.742	3.63	3.63	3.63		NA	NA		
Ni-63	7.1	8.97	8.04	1.322	3.92	3.92	3.92		NA	NA		
Sr-89	1.54	1.63	1.59	0.064	1.03	1.03	1.03		NA	NA		
Sr-90	1.65	1.69	1.67	0.028	1.22	1.22	1.22		NA	NA		
Tc-99	5.23	5.23	5.23	0.000	26.2	26.2	26.20		NA	NA		
I-129	8.96	9.45	9.21	0.346	13.2	13.2	0.00		NA	NA		
Pu-238	0.066	0.071	0.07	0.004	0.127	0.127	0.13		NA	NA		
Pu-239	0.065	0.066	0.07	0.001	0.127	0.127	0.13		NA	NA		
Pu-240	0.065	0.066	0.07	0.001	0.127	0.127	0.13		NA	NA		
Pu-241	0.065	0.066	0.07	0.001	9.66	9.66	9.66		NA	NA		
Am-241	0.049	0.058	0.05	0.006	0.131	0.131	0.13		NA	NA		
Cm-242	0.048	0.059	0.05	0.008	0.172	0.172	0.17		NA	NA		
Cm-243	0.045	0.054	0.05	0.006	0.117	0.117	0.12		NA	NA		
Cm-244	0.045	0.054	0.05	0.006	0.117	0.117	0.12		NA	NA		

TABLE 5-1

Preliminary List of Potentially Complete Exposure Pathways

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Exposure Medium	Exposure Route	Onsite-worker		Offsite-User of Shoreline Area		Residential		Construction Worker	
		Chemicals	Radionuclides	Chemicals	Radionuclides	Chemicals	Radionuclides	Chemicals	Radionuclides
Groundwater	Ingestion	NC	NC	NC	NC	C	C	NC	NC
	Dermal Contact	NC	NC	NC	NC	NC	NC	NC	NC
	Inhalation of VOCs	NC	NA	NC	NA	C	NA	NC	NC
Surface Water	Ingestion	NC	NC	NC	NC	NC	NC	NC	NC
	Dermal Contact	NC	NC	NC	NC	NC	NC	NC	NC
	Inhalation of VOCs	NC	NA	NC	NA	NC	NA	NC	NA
Sediment	Incidental Ingestion	NC	NC	C	C	NC	NC	NC	NC
	Dermal Contact	NC	NA	C	NA	NC	NA	NC	NA
	External Exposure	NA	NC	NA	C	NA	NC	NA	NC
Air	Inhalation of VOCs	C	NA	NC	NC	C	NA	C	NA
	Inhalation of Particulates	C	C	NC	NC	C	C	C	C
Soil/Dust	Incidental Ingestion	C	C	NC	NC	C	C	C	C
	Dermal Contact	C	NA	NC	NC	C	NA	C	NA
	External Exposure	NA	C	NA	NC	NA	C	NA	C
Food/Biota	Ingestion								
	Fish and Shellfish	NC	NC	C	C	NC	NC	NC	NC
	Meat and Game	NC	NC	NC	NC	NC	NC	NC	NC
	Dairy	NC	NC	NC	NC	NC	NC	NC	NC
	Eggs	NC	NC	NC	NC	NC	NC	NC	NC
	Fruits and Vegetables	NC	NC	NC	NC	C	C	NC	NC

C - Pathway is assumed to be complete for purposes of calculating cumulative risks

NC - Pathway is assumed to not be complete for purposes of calculating cumulative risks

NA - Pathway is not applicable for this medium or contaminant

TABLE 5-2
 Exposure Factors Used in Calculation of Contaminant Intakes
Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Receptor	Pathway	Symbol	Units	Value	Description	Reference
Resident	Soil Ingestion	IR _{si}	mg/day	120	Soil ingestion rate (0.001 g/mg is a conversion factor)	EPA, 2001
		EF	days/year	150	Exposure frequency	RFI HHRA Table 5-4 (MYAPC, 2004)
		ED	years	30	Exposure duration	EPA, 2001
	Produce Ingestion	I _{r_f}	kg/yr	7.7	Fruit (exposed produce) ingestion rate	EPA, 1998
		I _{r_v}	kg/yr	14.6	Vegetable (protected/root produce) ingestion rate	EPA, 1998
		I _{r_{lv}}	kg/yr	3.6	Leafy vegetable ingestion rate	EPA, 1998
		CPF	unitless	1	Contaminated plant fraction from site	
		B _f	unitless	nuclide-specific	Soil-to-plant transfer coefficient, for fruit	
		B _v	unitless	nuclide-specific	Soil-to-plant transfer coefficient, for protected/root vegetables	
		B _{lv}	unitless	nuclide-specific	Soil-to-plant transfer coefficient, for leafy vegetables	
	External Exposure	ACF	unitless	0.90	Area correction factor	EPA, 2001
		ET _o	unitless	0.073	Exposure time outdoors	EPA, 2001
		ET _i	unitless	0.683	Exposure time indoors	EPA, 2001
GSF		unitless	0.40	Indoor gamma shielding factor	EPA, 2001	

TABLE 5-2

Exposure Factors Used in Calculation of Contaminant Intakes

*Cumulative Risk Assessment**Maine Yankee Facility, Wiscasset, ME*

Receptor	Pathway	Symbol	Units	Value	Description	Reference
On-site worker	Soil Ingestion	IR _{si}	mg/day	100	Soil ingestion rate (0.001 g/mg is a conversion factor)	EPA, 1991
		EF	days/year	150	Exposure frequency	RFI HHRA Table 5-4 (MYAPC, 2004)
		ED	years	25	Exposure duration	EPA, 1991
	External Exposure	ACF	unitless	0.90	Area correction factor	EPA, 2001
		ET _o	unitless	0.167	Exposure time outdoors	Calculated value
		ET _i	unitless	0.167	Exposure time indoors	Calculated value
		GSF	unitless	0.40	Indoor gamma shielding factor	EPA, 2001
Construction worker	Soil Ingestion	IR _{si}	mg/day	330	Soil ingestion rate (0.001 g/mg is a conversion factor)	EPA, 2002
		EF	days/year	160	Exposure frequency	RFI HHRA Table 5-6 (MYAPC, 2004)
		ED	years	1	Exposure duration	RFI HHRA Table 5-6 (MYAPC, 2004)
	External Exposure	ACF	unitless	0.90	Area correction factor	EPA, 2001
		ET _o	unitless	0.333	Exposure time outdoors	Calculated value
		ET _i	unitless	0.000	Exposure time indoors	Calculated value
		GSF	unitless	0.40	Indoor gamma shielding factor	EPA, 2001

TABLE 5-3

Assumptions Used to Calculate Produce Ingestion in the HHRA
Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Parameters	Ingestion (kg/kg-day)	Ingestion (kg/day)	Ingestion (g/day)	Percent of Total	Ingestion kg/year (value used in CRA)
Exposed aboveground produce	0.0003	0.021	21	29.7%	7.7
Protected aboveground produce	0.00057	0.0399	39.9	56.4%	14.6
Belowground produce	0.00014	0.0098	9.8	13.9%	3.6
Body weight (kg)		70			
Total Produce Ingestion (g/day)			70.7		

Notes

Value for fruit/vegetable consumption used in the HHRA was 71 g/day (MYAPC, 2004).

Source: EPA, 1998, Table C-1-2, for produce categories and ingestion rates.

Protected aboveground produce and belowground produce are summed to obtain a rate of 18.1 kg/day.

TABLE 5-4
 Comparison of Produce Ingestion Parameters Used to Evaluate Radionuclide and Chemical Risks from Soil
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Scenario	Pathway	Parameter	Radionuclides			Chemicals	
			Value from NRC guidance used in LTP	Reference	Value from EPA Soil Screening Guidance (USEPA, 2000)	Value from EPA guidance used in the RFI HHRA	Reference for RFI HHRA Value
Residential	Produce Ingestion	Leafy vegetable consumption (kg/year)	11	NRC, 1992; Table 6.23	4.66	NA (this guidance groups this with fruits and vegetables consumption)	EPA, 1998
		Other vegetable consumption (kg/year)	51	NRC, 1992; Table 6.23	NA (this guidance groups fruit and vegetable consumption together)	NA (this guidance groups fruit and vegetable consumption together)	--
		Fruit consumption (kg/year)	46	NRC, 1992; Table 6.23	NA (this guidance groups fruit and vegetable consumption together)	NA (this guidance groups fruit and vegetable consumption together)	--
		Fruit and vegetable consumption (kg/year)	NA	--	42.7	see the notes ²	EPA, 1998
		Root (below ground) produce consumption (kg/year)	NA	--	NA	3.6	EPA, 1998

Notes:

1. NUREG/CR-5512 cites this as the food consumption period.
2. There is no separate fruit or leafy vegetable consumption fraction - the closest is "above ground" which includes leafy vegetables (14.6 kg/yr protected aboveground produce, and 7.7 kg/yr exposed aboveground produce, as shown in Table 1).

TABLE 6-1
 Cumulative Risk Assessment Summary - Soils
Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Exposure Unit	Description	Maximum Risks			Radionuclide Risk as a Percent of Cumulative Risk
		Radionuclide	Chemical	Cumulative	
EU-1	Plant Area				
	On-Site Resident	3.93E-06	2.32E-04	2.36E-04	1.66%
	On-Site Worker	1.04E-06	1.70E-06	2.74E-06	38.06%
	Construction Worker	2.03E-07	1.90E-06	2.10E-06	9.67%
EU-2	Warehouse 2/3				
	On-Site Resident	2.26E-07	1.91E-04	1.91E-04	0.12%
	On-Site Worker	5.47E-08	1.40E-06	1.45E-06	3.76%
	Construction Worker	4.33E-09	1.50E-06	1.50E-06	0.29%
EU-3	345 kV Transmission Line Area				
	On-Site Resident	1.18E-06	6.93E-05	7.05E-05	1.67%
	On-Site Worker	3.30E-07	5.90E-07	9.20E-07	35.86%
	Construction Worker	6.42E-08	7.40E-07	8.04E-07	7.98%
EU-4	Bailey House Area				
	On-Site Resident	7.13E-07	3.62E-05	3.69E-05	1.93%
	On-Site Worker	1.72E-07	3.10E-07	4.82E-07	35.75%
	Construction Worker	1.37E-08	3.90E-07	4.04E-07	3.39%
EU-5	Former Maintenance Truck Garage	No carcinogenic or radionuclide substances present. See text.			
EU-6	Parking Lot Area				
	On-Site Resident	2.18E-06	0.00E+00	2.18E-06	NA
	On-Site Worker	6.12E-07	0.00E+00	6.12E-07	NA
	Construction Worker	1.19E-07	0.00E+00	1.19E-07	NA
EU-7	Foxbird Island				
	On-Site Resident	1.03E-05	0.00E+00	1.03E-05	NA
	On-Site Worker	2.79E-06	0.00E+00	2.79E-06	NA
	Construction Worker	4.65E-07	0.00E+00	4.65E-07	NA
EU-8	Forebay				
	On-Site Resident	1.74E-05	0.00E+00	1.74E-05	NA
	On-Site Worker	4.80E-06	0.00E+00	4.80E-06	NA
	Construction Worker	8.74E-07	0.00E+00	8.74E-07	NA

Notes:

This represents the survey unit with the highest radionuclide risk.
 The chemical risk estimate is assumed to apply uniformly across the entire exposure unit.
 See Appendix E for the results for individual survey units.
 Construction worker chemical risk is the higher of surface and sub-surface risks.

TABLE 6-2
 Cumulative Risk Assessment Summary - Groundwater
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Radionuclide Monitoring Well	Estimated Risks		Cumulative Risk	Percent Contribution from Radionuclides
	Radionuclides	Chemicals		
206A	5.17E-08	5.10E-05	5.11E-05	0.10%
306	2.72E-08	5.10E-05	5.10E-05	0.05%
318A	3.18E-08	5.10E-05	5.10E-05	0.06%
318B	3.96E-09	5.10E-05	5.10E-05	0.01%
401A	1.22E-08	5.10E-05	5.10E-05	0.02%
401B	5.07E-08	5.10E-05	5.11E-05	0.10%
401C	3.81E-08	5.10E-05	5.10E-05	0.07%
402	0	5.10E-05	5.10E-05	0.00%
501	1.21E-09	5.10E-05	5.10E-05	0.00%
503	4.64E-08	5.10E-05	5.10E-05	0.09%
504	2.91E-08	5.10E-05	5.10E-05	0.06%
505A	1.62E-08	5.10E-05	5.10E-05	0.03%
505B	3.32E-08	5.10E-05	5.10E-05	0.07%
506	3.59E-08	5.10E-05	5.10E-05	0.07%
506C	4.79E-08	5.10E-05	5.10E-05	0.09%
502	1.22E-06	5.10E-05	5.22E-05	2.33%
507	NA	5.10E-05	5.10E-05	NA
508	NA	5.10E-05	5.10E-05	NA

Note:

See Tables 4-3 and 4-10 for chemical and radiological monitoring details.

Table 6-3
 Summary of Risks to Hypothetical Future Residents
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Exposure Unit	Exposure Pathway	Estimated Risks		
		Radionuclide	Chemical	Cumulative
EU-1 Plant Area	Soil Ingestion	3.8E-09	4.8E-06	4.8E-06
	Produce Ingestion	1.9E-07	1.8E-04	1.8E-04
	External Exposure	3.7E-06	NA	3.7E-06
	Groundwater Ingestion	1.7E-05	2.9E-05	4.6E-05
EU-2 Warehouse 2/3	Soil Ingestion	2.2E-10	3.1E-06	3.1E-06
	Produce Ingestion	1.1E-08	1.3E-04	1.3E-04
	External Exposure	2.1E-07	NA	2.1E-07
	Groundwater Ingestion	NA	2.9E-05	2.9E-05
EU-3 345 kV Transmission Line Area	Soil Ingestion	6.9E-10	3.8E-07	3.8E-07
	Produce Ingestion	3.4E-08	1.2E-05	1.2E-05
	External Exposure	1.2E-06	NA	1.2E-06
	Groundwater Ingestion	NA	2.9E-05	2.9E-05
EU-4 Bailey House Area	Soil Ingestion	0.0E+00	0.0E+00	0.0E+00
	Produce Ingestion	0.0E+00	0.0E+00	0.0E+00
	External Exposure	0.0E+00	NA	0.0E+00
	Groundwater Ingestion	NA	2.9E-05	2.9E-05
EU-5 Former Maintenance Truck Garage	Soil Ingestion	0.0E+00	0.0E+00	0.0E+00
	Produce Ingestion	0.0E+00	0.0E+00	0.0E+00
	External Exposure	0.0E+00	NA	0.0E+00
	Groundwater Ingestion	NA	2.9E-05	2.9E-05
EU-6 Parking Lot Area	Soil Ingestion	6.9E-10	0.0E+00	6.9E-10
	Produce Ingestion	3.4E-08	0.0E+00	3.4E-08
	External Exposure	2.2E-06	NA	2.2E-06
	Groundwater Ingestion	NA	2.9E-05	2.9E-05
EU-7 Foxbird Island	Soil Ingestion	4.2E-09	0.0E+00	4.2E-09
	Produce Ingestion	2.3E-07	0.0E+00	2.3E-07
	External Exposure	1.0E-05	NA	1.0E-05
	Groundwater Ingestion	NA	2.9E-05	2.9E-05
EU-8 Forebay	Soil Ingestion	5.0E-09	0.0E+00	5.0E-09
	Produce Ingestion	2.9E-07	0.0E+00	2.9E-07
	External Exposure	1.7E-05	NA	1.7E-05
	Groundwater Ingestion	NA	2.9E-05	2.9E-05

Notes:

Chemical risk represents the Central Tendency value.

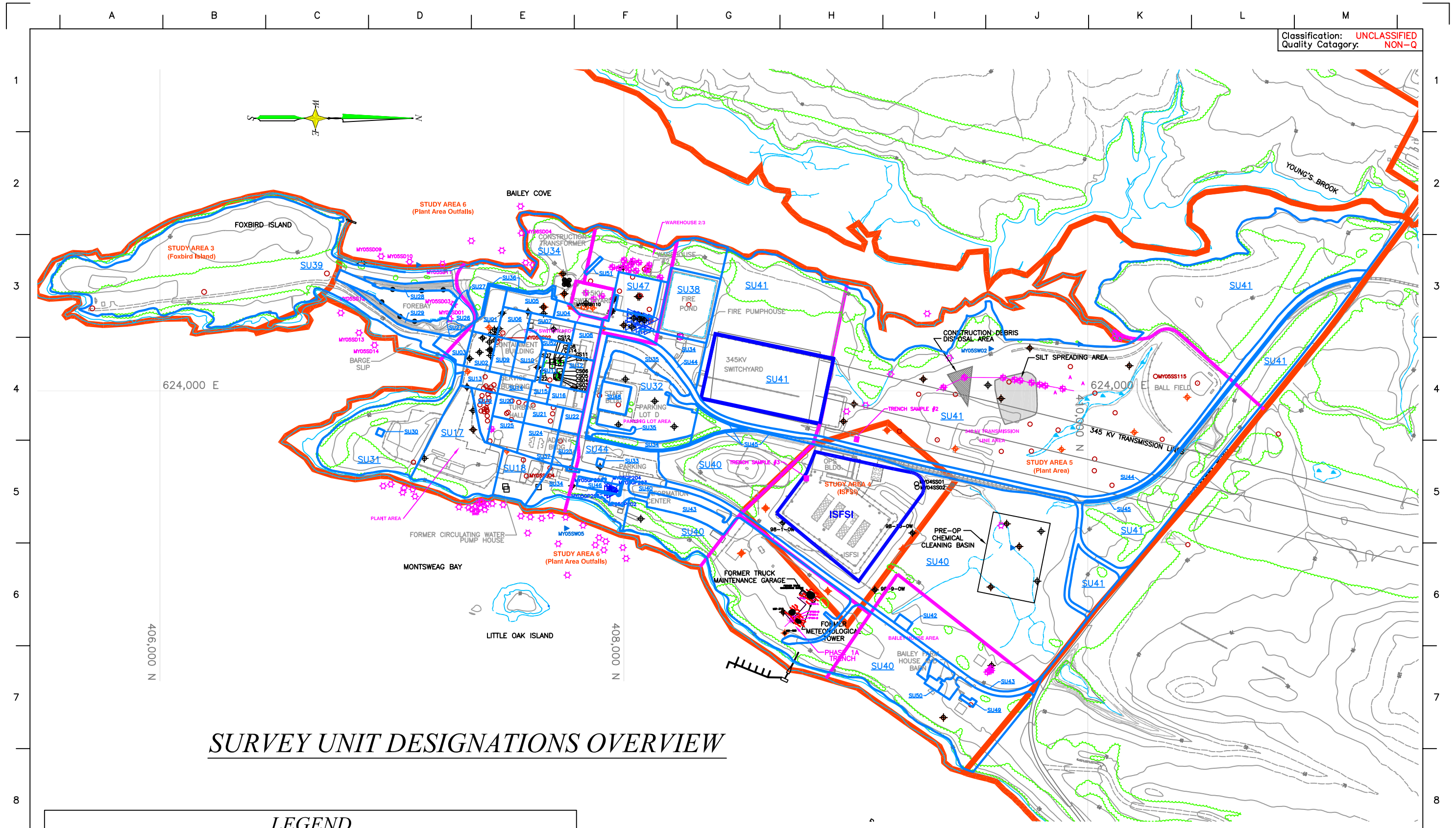
Chemical risk excludes arsenic which is a background constituent not related to site activities.

Radiological risk is based on the FGR-13/HEAST methodology. See Tables B-23 and F-6 for a comparison of risk values for FGR-11/12 and FGR-13 and the report text, Section 6.3.1.2, Uncertainties in Soil Risk Estimates.

Groundwater ingestion is an unlikely exposure pathway due to the presence of institutional controls.

NA - external exposure is not applicable for chemicals; groundwater ingestion of radionuclides is likely to be a complete pathway only within the Plant Area (see Section 6.3.2 of the text)

Figures



SURVEY UNIT DESIGNATIONS OVERVIEW


LEGEND

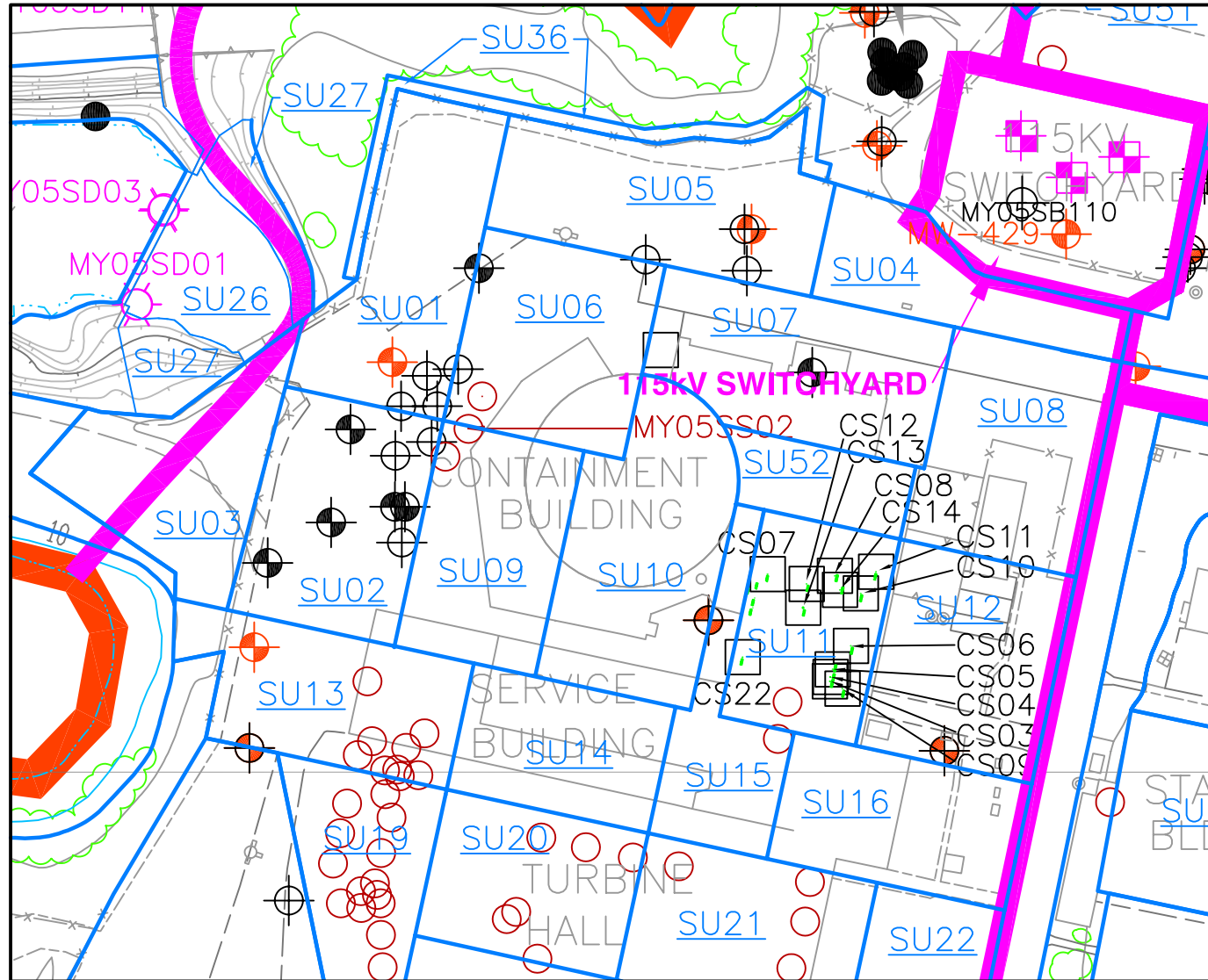
- | | |
|---|--|
| <ul style="list-style-type: none"> RAILROAD TOPOGRAPHIC CONTOURS UTILITY LINES (USGS QUAD) WATER WAY / STREAM / RIVER SURVEY UNIT DESIGNATIONS TRENCH EXCAVATIONS STUDY AREA DESIGNATIONS | <ul style="list-style-type: none"> MY05SS76 SURFACE SOIL SAMPLE LOCATION MY04SS01 SOIL SAMPLE LOCATION MY05SB47 SOIL BORING SAMPLE LOCATION MY05SD18 SEDIMENT SAMPLE LOCATION MY05TP104 TEST PIT LOCATION MW-324 MONITORING WELL LOCATION MY05SW02 SURFACE WATER SAMPLE LOCATION |
|---|--|

MAINE YANKEE - Cumulative Risk Assessment					
DRAWINGS PRODUCED BY: BLACK DIAMOND CONSULTANTS, INC 312 WATER STREET GARDINER, ME 04345				DRAWING TITLE: SURVEY UNIT DESIGNATION OVERVIEW	
DATE PREPARED: 10-31-06	DESIGNED BY: MAW	DRAWN BY: AMC	CHECKED BY: RLW	REVIEWED BY: MAW	
PROJECT NAME/FILE NAME: CRA-01		PROJECT NUMBER/PHASE: MY-02		PREPARED FOR: MAINE YANKEE ATOMIC POWER CO.	
					FIGURE NO. 3-1

Survey Unit Designation	Survey Area	Survey Unit	Survey Description
SU01	FR0100	1	Yard West (2)
SU02	FR0100	2	Yard West (2)
SU03	FR0100	3	Yard West
SU04	FR0111	8	Soil Remediation Areas
SU05	FR0111	9	Soil Remediation Areas
SU06	FR0111	10	Soil Remediation Areas
SU07	FR0111	11	Soil Remediation Areas
SU08	FR0111	12	Soil Remediation Areas
SU09	FR0111	13	Soil Remediation Areas
SU10	FR0111	14	Soil Remediation Areas
SU11	FR0111	15	Soil Remediation Areas
SU12	FR0111	16	Soil Remediation Areas
SU13	FR0111	17	Soil Remediation Areas
SU14	FR0111	18	Soil Remediation Areas
SU15	FR0111	19	Soil Remediation Areas
SU16	FR0111	20	Soil Remediation Areas
SU17	FR0200	1	Yard East
SU18	FR0200	2	Yard East
SU19	FR0200	3	Yard East
SU20	FR0200	4	Yard East
SU21	FR0200	5	Yard East
SU22	FR0200	6	Yard East
SU23	FR0200	7	Yard East
SU24	FR0200	8	Yard East
SU25	FR0200	9	Yard East
SU26	FR0400	1	Forebay Seal Pit Floor

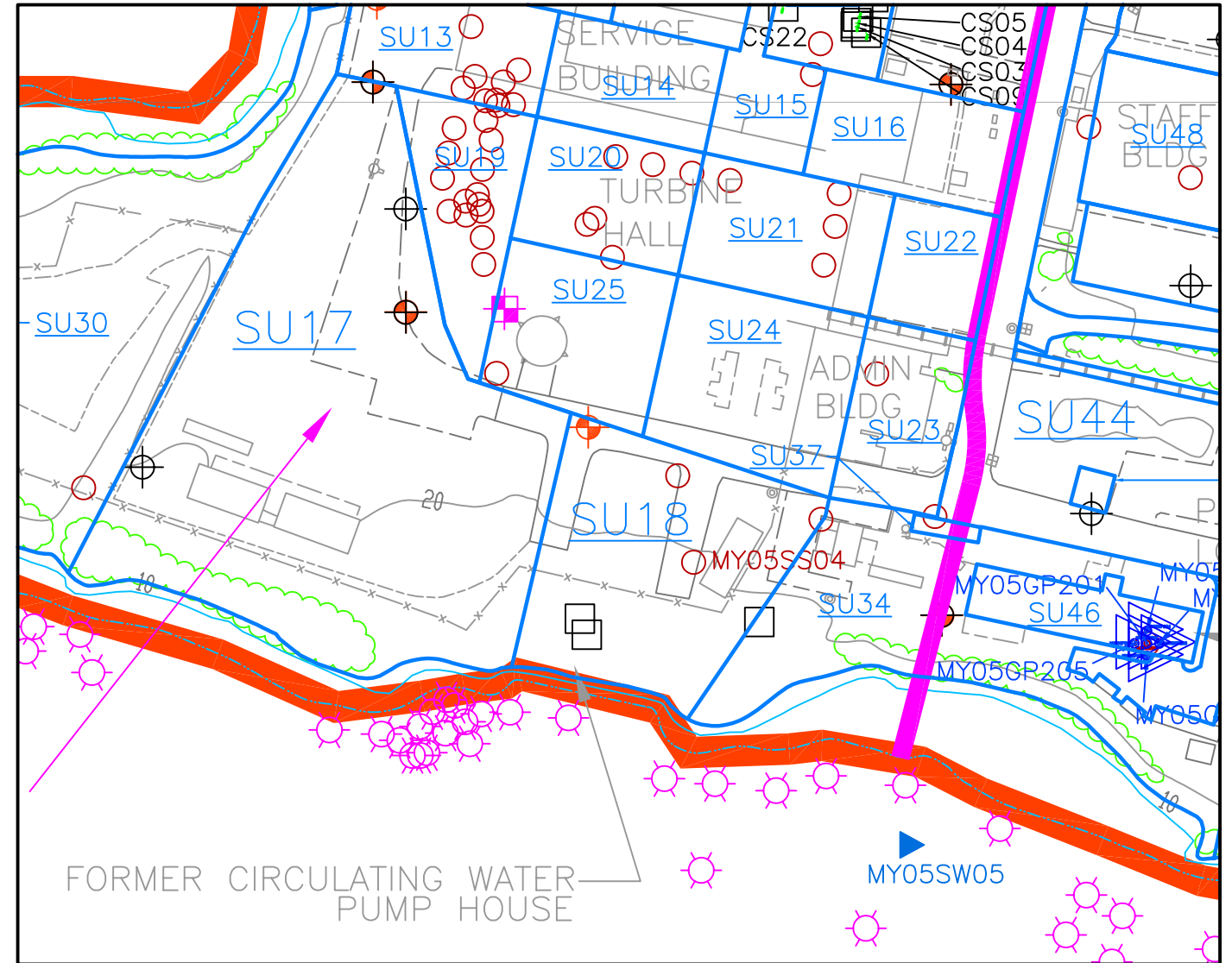
Survey Unit Designation	Survey Area	Survey Unit	Survey Description
SU27	FR0400	2	Forebay Seal Pit Slopes
SU28	FR0400	7	Forebay West Side
SU29	FR0400	8	Forebay East Side
SU30	FR0500	1	Bailey Point
SU31	FR0500	2	Bailey Point
SU32	FR0800	1	Admin and Parking Areas
SU33	FR0810	1	Collection Site Sub Slab
SU34	FR0900	1	BOP Land
SU35	FR0900	2	BOP Land
SU36	FR0900	3	BOP Land
SU37	FR0900	4	BOP Land
SU38	FR0910	1	Fire Pond
SU39	FR1000	0	Foxbird Island
SU40	FR1800	1	Bailey Land
SU41	FR1800	2	Bailey Land
SU42	FR1800	3	Bailey Land
SU43	FR2900	1	Final Grade, Rails, Roads, Staff Building Parking Lot, Lots E & C
SU44	FR2900	2	Final Grade, Rails, Roads, Staff Building Parking Lot, Lots E & C
SU45	FR2900	3	Final Grade, Rails, Roads, Staff Building Parking Lot, Lots E & C
SU46	FB1400	1	Information Center
SU47	FB1500	1	Warehouse 2/3
SU48	FB1700	1	Staff Building
SU49	FB1900	1	Bailey House Footprint
SU50	FB2000	1	Bailey Barn Footprint
SU51	FB2600	1	Warehouse 5
SU52	FA0400	1	Fuel Building Footprint

MAINE YANKEE - Cumulative Risk Assessment					
				DRAWINGS PRODUCED BY: BLACK DIAMOND CONSULTANTS, INC 312 WATER STREET GARDINER, ME 04345	
DATE PREPARED: 10-31-06		DESIGNED BY: MAW	DRAWN BY: AMC	CHECKED BY: RLW	REVIEWED BY: MAW
PROJECT NAME/FILE NAME: CRA-01			PROJECT NUMBER/PHASE: MY-02		DRAWING TITLE: SURVEY UNIT DESIGNATION TABLE
PREPARED FOR: MAINE YANKEE ATOMIC POWER CO.					FIGURE NO. 3-2



SURVEY UNIT DESIGNATIONS SU01 - SU16

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SURVEY UNIT DESIGNATIONS SU17 - SU25

NOT TO SCALE - SHOWN FOR REFERENCE ONLY

LEGEND

- RAILROAD
- TOPOGRAPHIC CONTOURS
- UTILITY LINES (USGS QUAD)
- WATER WAY / STREAM / RIVER
- SURVEY UNIT DESIGNATIONS
- TRENCH EXCAVATIONS
- STUDY AREA DESIGNATIONS
- MY05SS76 SURFACE SOIL SAMPLE LOCATION
- MY04SS01 SOIL SAMPLE LOCATION
- MY05SB47 SOIL BORING SAMPLE LOCATION
- MY05SD18 SEDIMENT SAMPLE LOCATION
- MY05TP104 TEST PIT LOCATION
- MW-324 MONITORING WELL LOCATION
- MY05SW02 SURFACE WATER SAMPLE LOCATION

MAINE YANKEE - Cumulative Risk Assessment

Maine Yankee

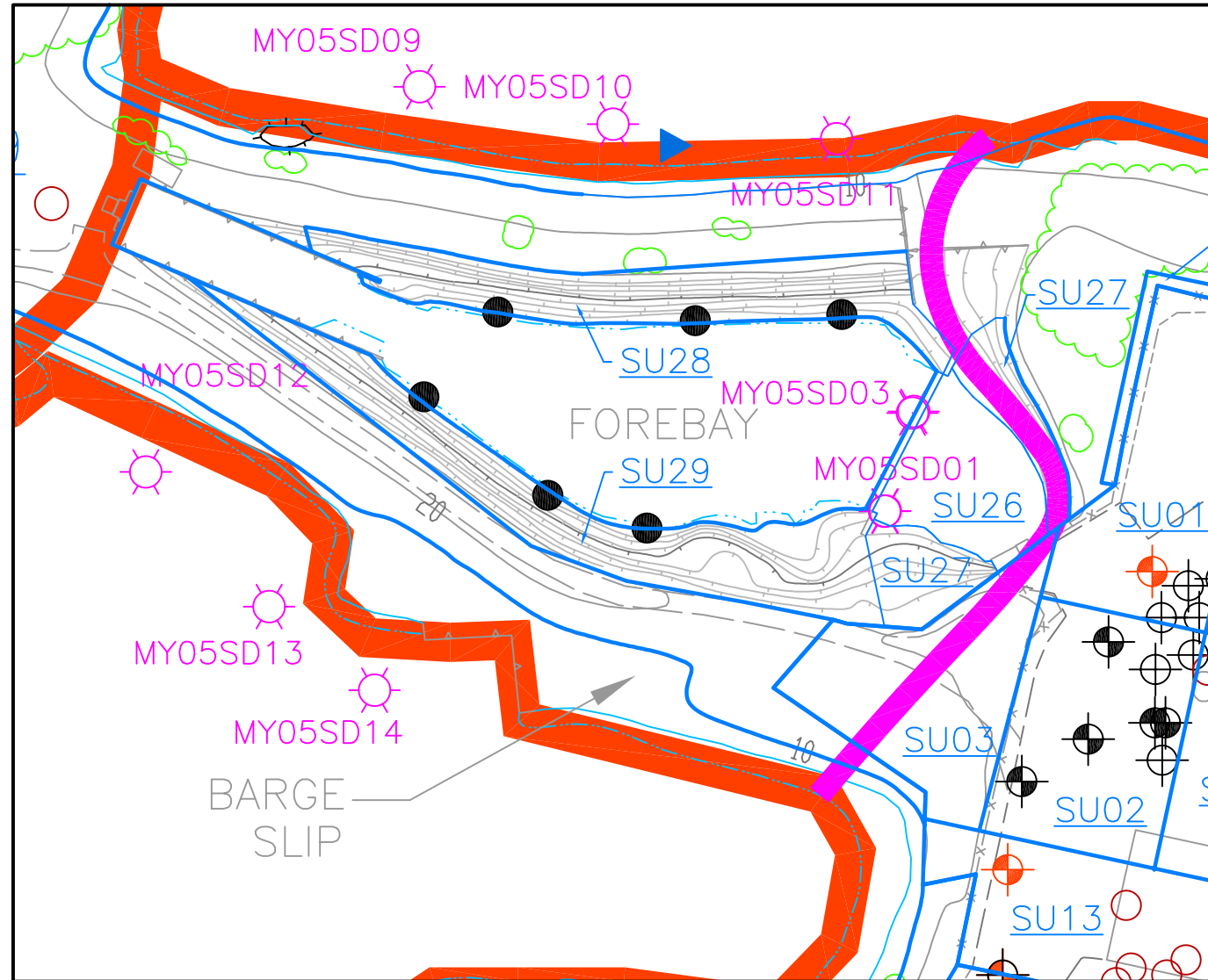
DRAWINGS PRODUCED BY:
BLACK DIAMOND CONSULTANTS, INC
312 WATER STREET GARDINER, ME 04345

DATE PREPARED: 10-31-06	DESIGNED BY: MAW	DRAWN BY: AMC	CHECKED BY: RLW	REVIEWED BY: MAW
PROJECT NAME/FILE NAME: CRA-01		PROJECT NUMBER/PHASE: MY-02		

DRAWING TITLE:
SURVEY UNIT DESIGNATION DETAIL
SU01 - SU25

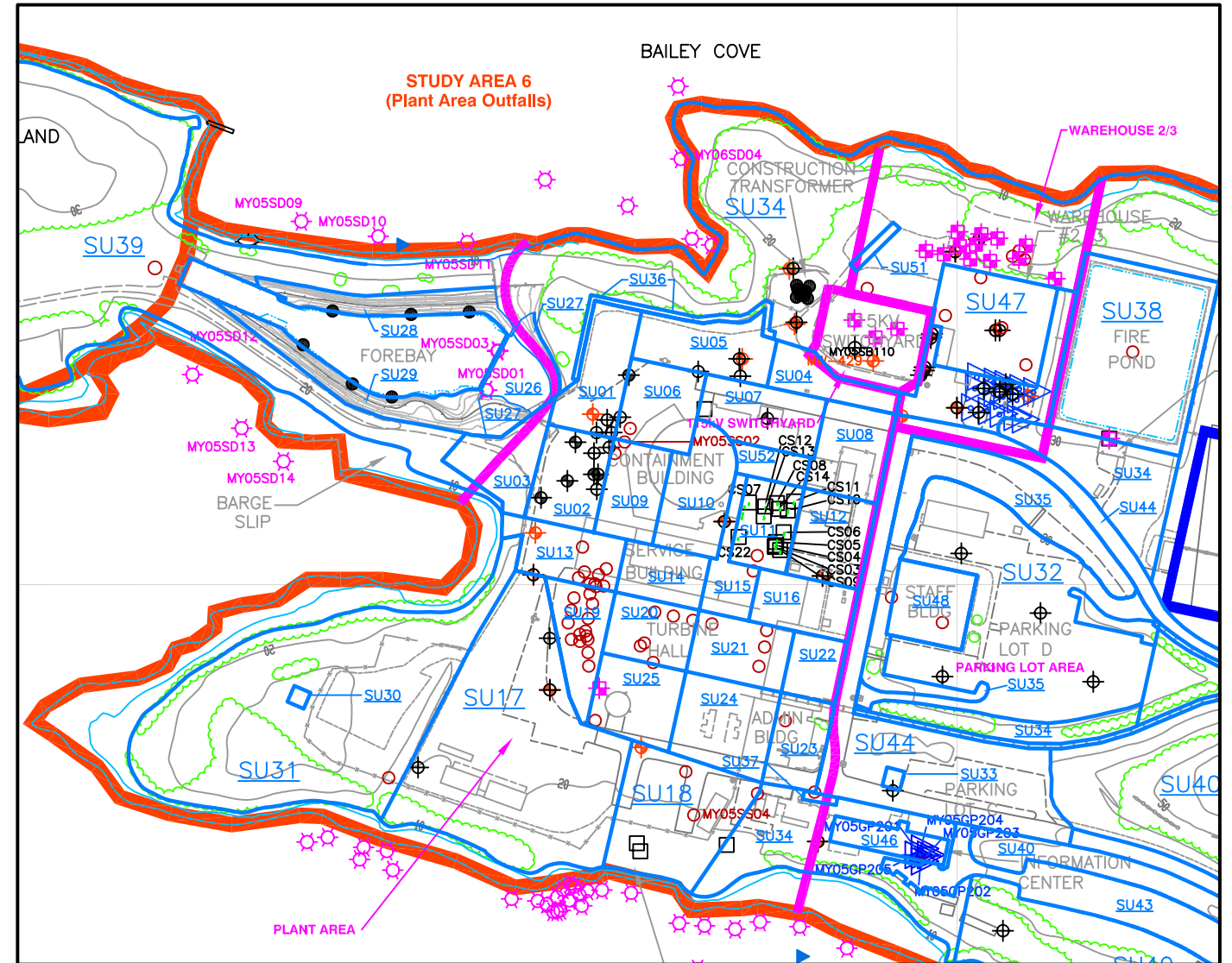
PREPARED FOR:
MAINE YANKEE ATOMIC POWER CO.

FIGURE NO. **3-3**



SURVEY UNIT DESIGNATIONS SU26 - SU29

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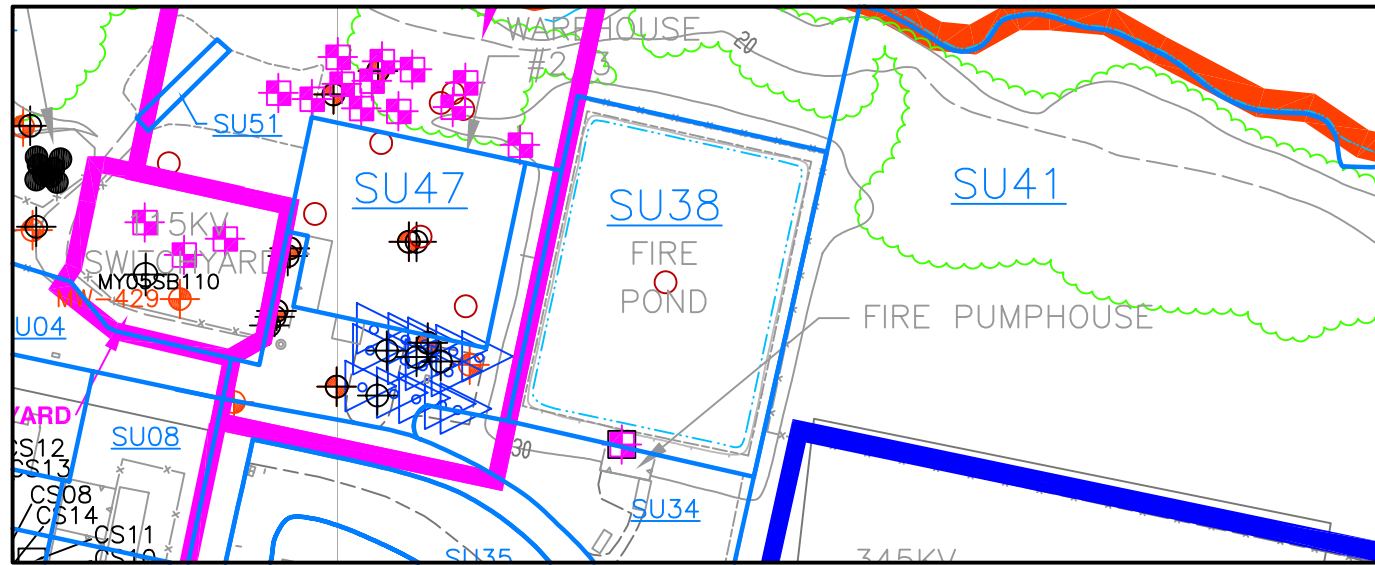
SURVEY UNIT DESIGNATIONS SU30 - SU37

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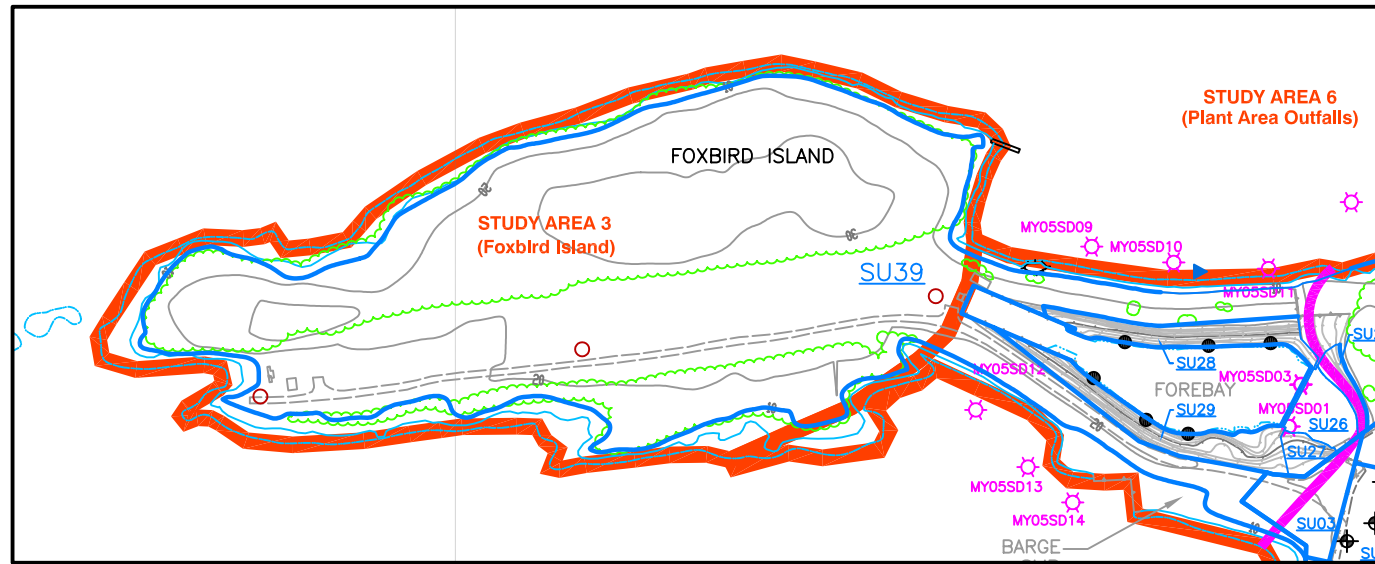
LEGEND

- RAILROAD
- TOPOGRAPHIC CONTOURS
- UTILITY LINES (USGS QUAD)
- WATER WAY / STREAM / RIVER
- SURVEY UNIT DESIGNATIONS
- TRENCH EXCAVATIONS
- STUDY AREA DESIGNATIONS
- MY05SS76 SURFACE SOIL SAMPLE LOCATION
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- MY05SD18 SEDIMENT SAMPLE LOCATION
- MY05TP104 TEST PIT LOCATION
- MW-324 MONITORING WELL LOCATION
- MY05SW02 SURFACE WATER SAMPLE LOCATION

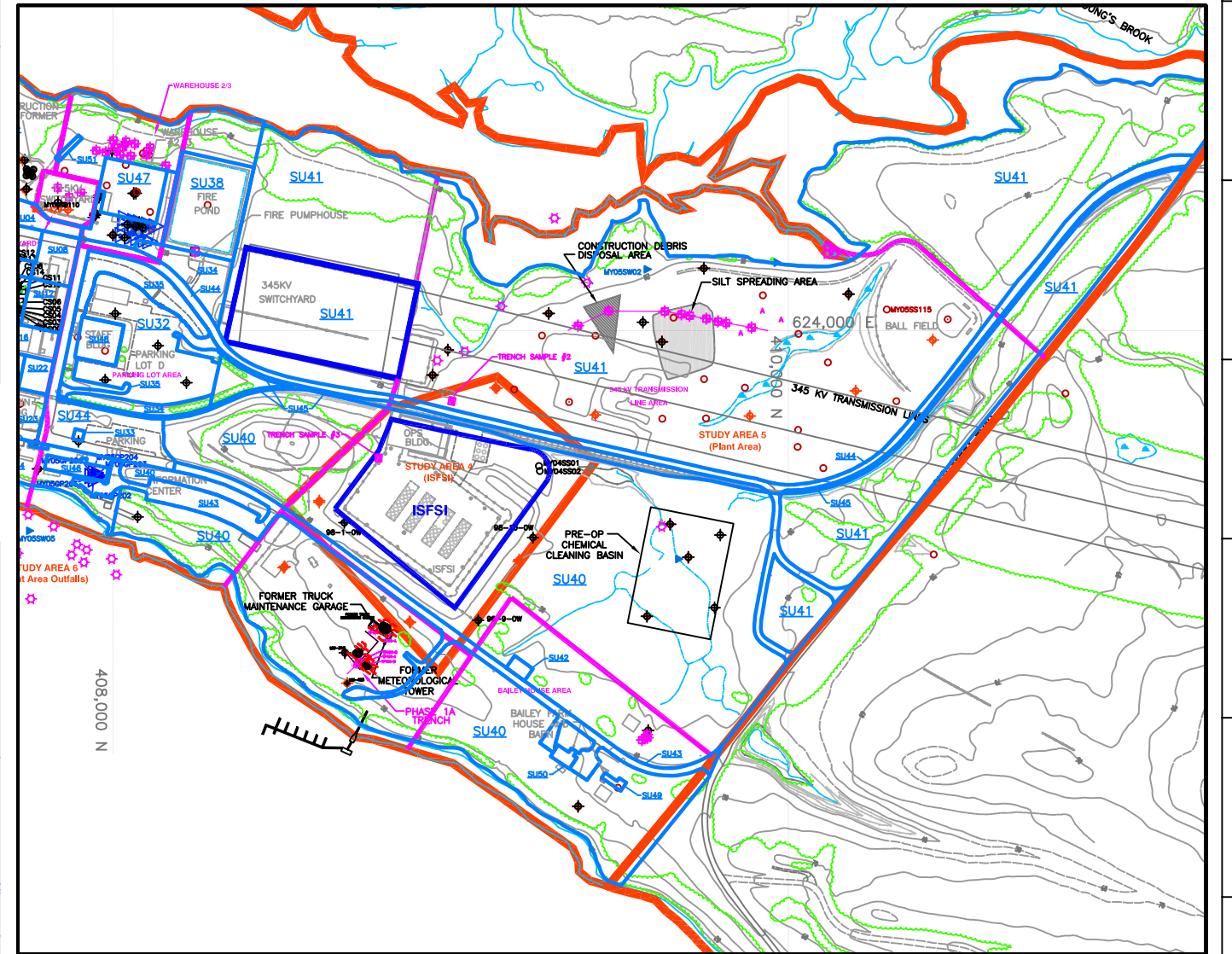
Maine Yankee		MAINE YANKEE - Cumulative Risk Assessment				
		DRAWINGS PRODUCED BY: BLACK DIAMOND CONSULTANTS, INC 312 WATER STREET GARDINER, ME 04345			DRAWING TITLE: SURVEY UNIT DESIGNATION DETAIL SU26 - SU37	
DATE PREPARED: 10-31-06	DESIGNED BY: MAW	DRAWN BY: AMC	CHECKED BY: RLW	REVIEWED BY: MAW	FIGURE NO. 3-4	
PROJECT NAME/FILE NAME: CRA-01		PROJECT NUMBER/PHASE: MY-02		PREPARED FOR: MAINE YANKEE ATOMIC POWER CO.		



SURVEY UNIT DESIGNATION SU38
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SURVEY UNIT DESIGNATION SU39
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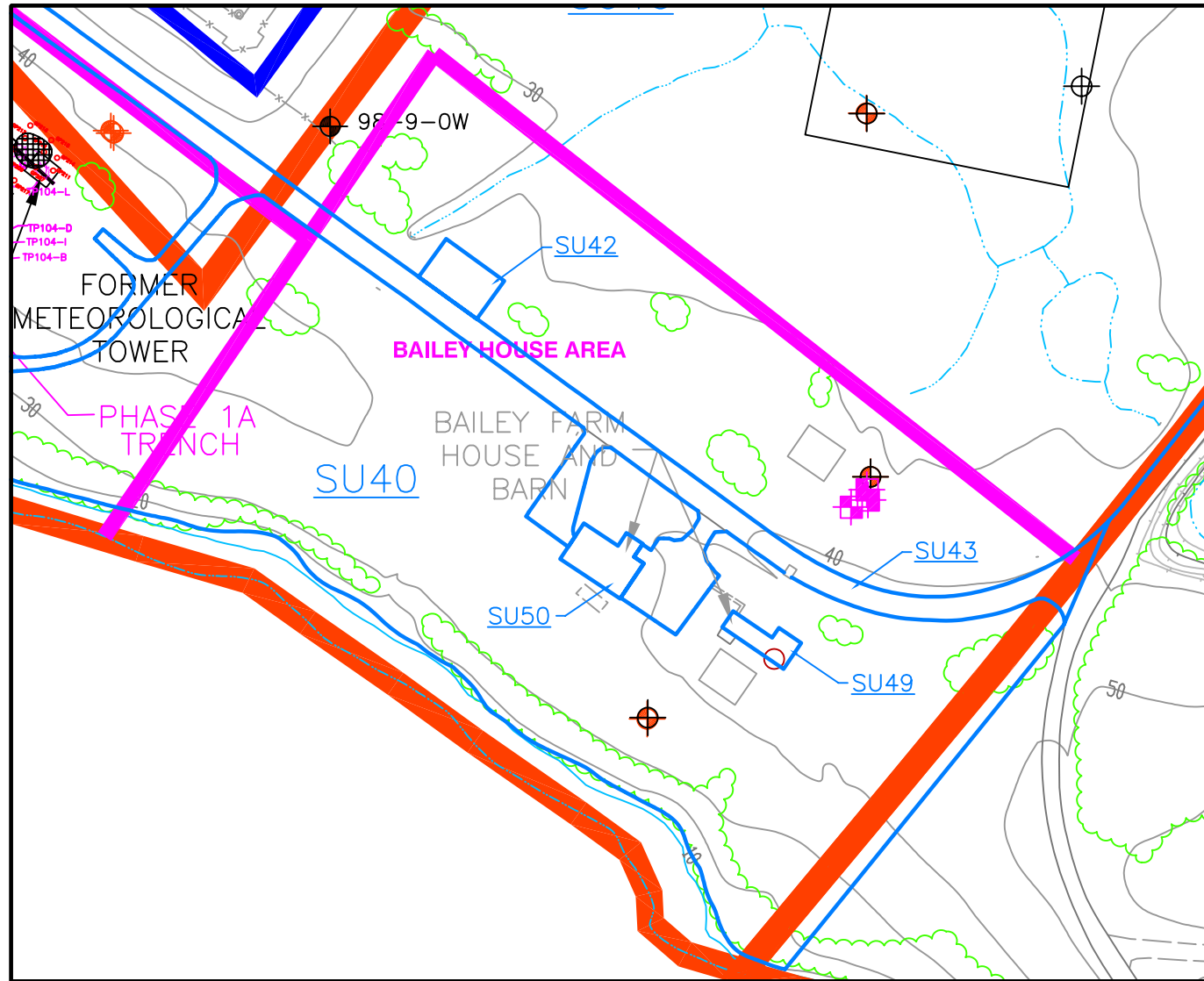


SURVEY UNIT DESIGNATIONS SU40 - SU48
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LEGEND

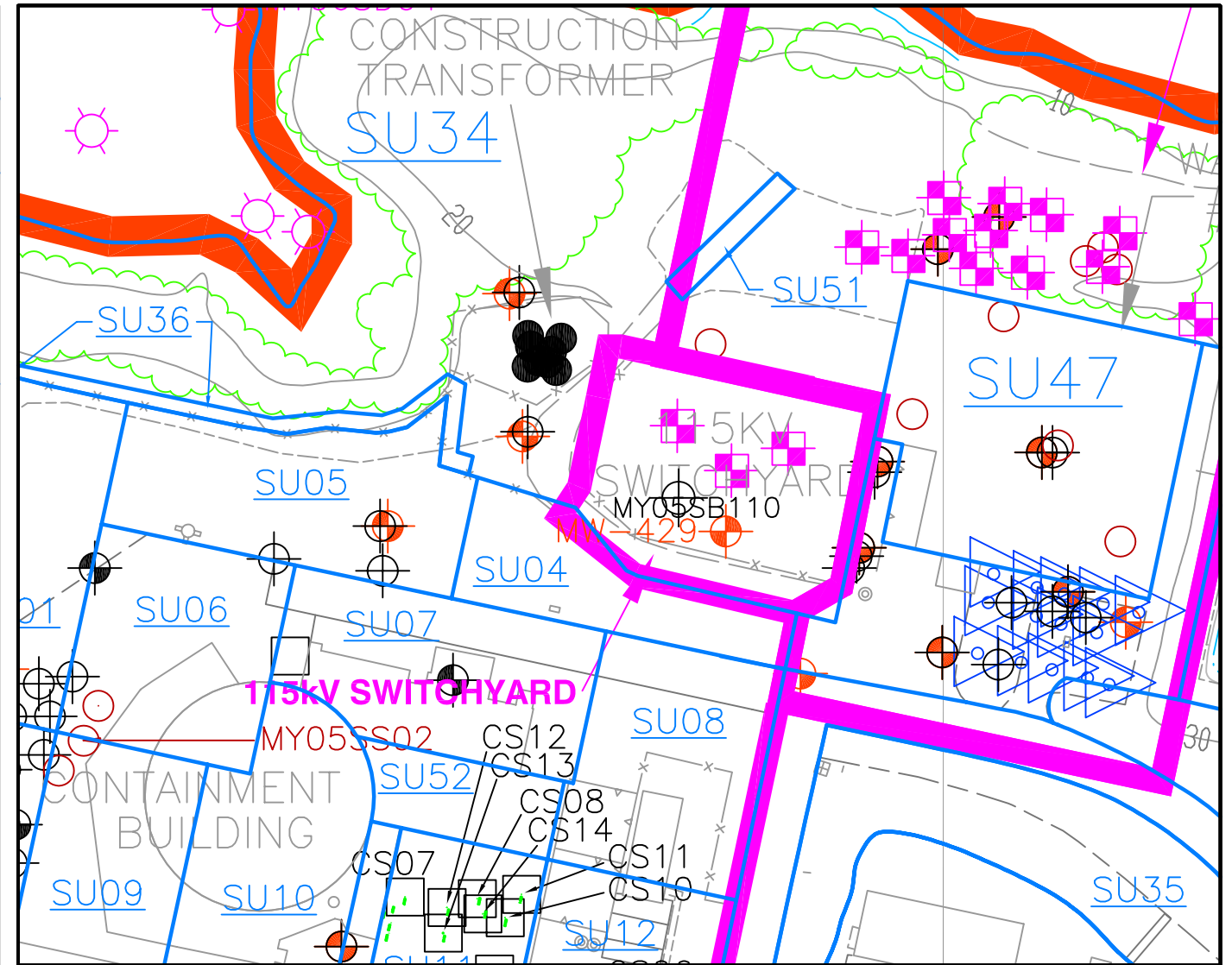
RAILROAD	○ MY05SS76 SURFACE SOIL SAMPLE LOCATION
~50~ TOPOGRAPHIC CONTOURS	○ MY04SS01 SOIL SAMPLE LOCATION
UTILITY LINES (USGS QUAD)	⊕ MY05SB47 SOIL BORING SAMPLE LOCATION
WATER WAY / STREAM / RIVER	☆ MY05SD18 SEDIMENT SAMPLE LOCATION
SURVEY UNIT DESIGNATIONS	⊕ MY05TP104 TEST PIT LOCATION
TRENCH EXCAVATIONS	⊕ MW-324 MONITORING WELL LOCATION
STUDY AREA DESIGNATIONS	▲ MY05SW02 SURFACE WATER SAMPLE LOCATION

Maine Yankee	MAINE YANKEE - Cumulative Risk Assessment				
	DRAWINGS PRODUCED BY: BLACK DIAMOND CONSULTANTS, INC 312 WATER STREET GARDINER, ME 04345			DRAWING TITLE: SURVEY UNIT DESIGNATION DETAIL SU38 - SU48	
DATE PREPARED: 10-31-06	DESIGNED BY: MAW	DRAWN BY: AMC	CHECKED BY: RLW	REVIEWED BY: MAW	FIGURE NO. 3-5
PROJECT NAME/FILE NAME: CRA-01		PROJECT NUMBER/PHASE: MY-02		PREPARED FOR: MAINE YANKEE ATOMIC POWER CO.	



SURVEY UNIT DESIGNATIONS SU49 - SU50

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SURVEY UNIT DESIGNATIONS SU51 - SU52

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LEGEND

- RAILROAD
- TOPOGRAPHIC CONTOURS
- UTILITY LINES (USGS QUAD)
- WATER WAY / STREAM / RIVER
- SURVEY UNIT DESIGNATIONS
- TRENCH EXCAVATIONS
- STUDY AREA DESIGNATIONS
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- MY04SS01 SOIL SAMPLE LOCATION
- MY05SB47 SOIL BORING SAMPLE LOCATION
- MY05SD18 SEDIMENT SAMPLE LOCATION
- MY05TP104 TEST PIT LOCATION
- MW-324 MONITORING WELL LOCATION
- MY05SW02 SURFACE WATER SAMPLE LOCATION

MAINE YANKEE - Cumulative Risk Assessment

Maine Yankee

DRAWINGS PRODUCED BY:
BLACK DIAMOND CONSULTANTS, INC
312 WATER STREET GARDINER, ME 04345

DRAWING TITLE:
SURVEY UNIT DESIGNATION DETAIL
SU49 - SU52

DATE PREPARED: 10-31-06
DESIGNED BY: MAW
DRAWN BY: AMC
CHECKED BY: RLW
REVIEWED BY: MAW

PREPARED FOR: MAINE YANKEE ATOMIC POWER CO.

PROJECT NAME/FILE NAME: CRA-01
PROJECT NUMBER/PHASE: MY-02

FIGURE NO. **3-6**

APPENDIXES

Appendix A
Meeting Notes – Cumulative Risk Assessment
Approach

Meeting Minutes – State of Maine Cumulative Risk Policy Discussion

Meeting Minutes

State of Maine and Maine Yankee Cumulative Risk Policy Discussion

Date: July 10, 2002

Location: Ray Bldg. Augusta, ME

Attendees:

<u>MDEP</u>	<u>BOH</u>	<u>Maine Yankee</u>
Brooke Barnes	Dr. Andy Smith	Tom Williamson
Joan M. Jones	Eric Frohberg	John Rendall, CH2Mhill
	Heather C. Lynch	Keith Dinger, Oversight

VIA Phone:

Mary Ballew, Mike Boyd, Phil Newkirk, US EPA

On behalf of Maine Yankee: Beth Walters, Joe Darman, John Lowe

Today's originally scheduled technical discussion was postponed until next month. Instead the meeting was a policy discussion to address and clarify the cumulative risk assessment process. Four key policy questions are outlined following background text with the understandings and agreements reached.

BACKGROUND: The state statute governing cleanup of a nuclear facility (38 MRS. 1455) provides for a specific dose limit for radionuclides as well as providing for an assessment of cumulative (radionuclide and chemical) risks. In particular, the statute specifies the following:

“Radiation dose standard. The site at which the decommissioning of a nuclear power plant has been completed must meet the following standards, as determined by the department:

- The residual radioactivity distinguishable from background radiation results in a total effective dose equivalent to an average member of the critical group of not more than 10 millirems...per year, including that from groundwater sources of drinking water.
- The residual radioactivity distinguishable from background radiation in groundwater sources of drinking water results in a total effective dose equivalent of not more than 4 millirems...per year to the average member of the critical group.

Cumulative risk assessment. The department” (DEP) “shall evaluate the cumulative risk posed by radiological and chemical contaminants that will remain at the site at which the decommissioning of a nuclear power plant is occurring or has been completed. In undertaking its evaluation, the department shall consider any proposed institutional and engineering controls.”

CUMULATIVE RISK ASSESSMENT POLICY ISSUES:

1. When is the cumulative risk assessment to be completed?

Both parties concur that Maine Yankee is required to perform a cumulative risk assessment to estimate risks associated with the site after remediation for radiological and chemical contaminants is complete.

2. Maine Yankee proposes to evaluate Bailey Point under an industrial use scenario only. What are the pros and cons of using an industrial versus residential use scenario?

Maine Yankee has proposed to evaluate the cumulative risk associated with the Bailey Point portion of the site (around 150 acres in size) under an assumption of future industrial/commercial use with institutional controls prohibiting future residential use. After discussion, the parties agree that a reasonable goal is to limit the size of site areas that warrant such controls as much as possible. It was agreed that the cumulative risk assessment evaluate estimates of risks under residential future use assumptions for Bailey Point in addition to industrial/commercial future use assumptions as a way to evaluate where institutional controls (e.g., deed or zoning restrictions) are needed.. Further technical discussions will occur to reconcile differences between the LTP residential farmer scenario and the RCRA residential scenario.

3. *What are the clean up standards DEP and MY are targeting, and how do they relate to the cumulative risk assessment?*

The Legislature determined that the appropriate clean up standard for radionuclides at a decommissioning nuclear power plant is the 10/4 mrem/yr for the average member of the critical group dose standard reflected in statute (38 MRSA, 14-A(I) § 1455). The critical group is defined under this statute as “the group of individuals reasonably expected to receive the greatest exposure to residual radioactivity for any applicable set of circumstances.” Maine Yankee is defining the critical group as a resident farmer as required by NRC regulations for license termination. The Legislature considered setting a risk-based standard for radiation, but chose a non-risk based (i.e., dose-based) standard instead. The parties agree that clean up to the 10/4 mrem/yr standard imposed by the Legislature is the radiological cleanup standard to which Maine Yankee will ultimately be held. The parties acknowledge that a dose of 10 mrem/yr for the average member of the critical group results in a incremental lifetime cancer risk (ILCR) number greater than the one in one hundred thousand for the average member of the critical group.

The statute does not specify a risk target against which the cumulative risk assessment is to be measured. For all other hazardous waste sites, the Maine DEP and DHS have set 1 per hundred thousand (10^{-5}) as the “upper bound for an acceptable ILCR for all media, for both residential and commercial/industrial scenarios³”. This guideline will be applied to various exposure pathways and scenarios related to chemical contaminants. The parties agree that this guideline is an appropriate benchmark for the evaluation of the cumulative ILCR of agents causing cancer by mechanisms of chemical toxicity and radioactive decay on the Maine Yankee site. The parties acknowledge that certain limited areas of the site (possibly as small as one acre) may meet the 10/4 dose standard yet still pose a cumulative risk greater than 10^{-5} . Maine Yankee is agreeable to evaluating the use of institutional controls for these areas once the actual risks are known.

4. *How will the cumulative risk assessment be used?*

The parties agree that the cumulative risk assessment can be used to meet the legislative mandate to evaluate cumulative ILCR. The resulting risk assessment document will establish a clear and

³ Guidance Manual for Human Health Risk Assessments at Hazardous Waste Substance Sites, State of Maine, Department of Environmental Protection and Department of Human Services, June 1994; p. 5-3.

transparent summary of the site's risks. The cumulative risk assessment can additionally be used as a tool for evaluating the land area where institutional controls such as deed or zoning restrictions are warranted, by comparison of estimate ILCR to the same guideline routinely applied by the DEP at other hazardous waste sites. The goal of minimizing the amount of land that is restricted to future industrial/commercial use will permit the Department to represent that as much of the site as possible meets the same risk level as other contaminated sites in Maine.

C/ MY summary 7/10/02

Maine Yankee Cumulative Risk Assessment Working Meeting, August 1, 2006

ATTENDEES:

Jim Connell/MYAPC
Mike Whitney/MYAPC
John Lowe/CH2M HILL
John Rendall/CH2M HILL
Joan Joans/MDEP
Eric Fromberg/MBOH
Abel Russ/MBO

FROM: CH2M HILL

DATE: August 9, 2006

Introduction – Role for the Cumulative Risk Assessment

Eric: the content of the Cumulative Risk Assessment (CRA) will depend on how it's going to be used in the future:

- It is intended to provide a realistic estimate of total risks after cleanup.
- It is intended to allow policy makers to understand how to manage the site in the future.
- For example, regarding institutional controls – while there is an acknowledgement that Maine Yankee is different from other sites in Maine (principally because of the presence of the ISFSI), the way of addressing institutional controls needs to be consistent with other sites. If institutional controls are risk-based, what is the footprint where they are required? Is it possible to analyze risks at the site to make the footprint requiring institutional controls as small as feasible?
- The CRA not meant to drive remediation but to determine where combined risk exceeds 10^{-5} and where it doesn't (for purposes of defining where the institutional controls need to be applied)

In structuring the report, the objectives are to be clear and transparent presentation of the data, define CR for the site per regulatory requirements, define smallest area for institutional controls, and provide a “free standing” or standalone report with a minimum of reference to information in other documents (within reason). For example:

- Include summary of LTP data for each survey unit (sample size, standard deviation, etc.)
- Include more visuals – figures showing data points, exposure units, etc.
- Explain areas where both rad and chemical risks are “zero” (i.e., background) such as Foxboro Island

Methods for Combining Risk Estimates

Maine Yankee agreed with combining radiological and chemical risks even if one source is zero. Further discussion is presented below concerning how this would work in practice, given the differences in spatial coverage between the chemical and radionuclide data.

Maine Yankee agreed to combine radiological and chemical risks based using the same method for calculating exposure point concentrations; this will be the mean concentration across the different exposure units (i.e. the investigation areas used in the RFI/HHRA, and the survey units in the FSS. The state requested summary statistics (sample size, mean and standard deviation) for these units. These data presentations should be available for the chemical constituents in the RFI (these calculations would be developed for the HHRA); they may also be available for the radionuclide data in the FSS survey packages – if not these statistics can be calculated.

The state asked that the CRA report compare and present the assumptions in dose conversion factors for both chemicals and radionuclides. For example, Eric noted that the cancer slope factors (for the chemical constituents) and the dose conversion factors (for radionuclides) have a lot of embedded assumptions. He would like to see a comparison of these assumptions.

Eric recommended doing this comparison using the radionuclide slope factors presented in EPA's FGR-13 guidance. While there is a preference to retain the dose conversion factors FGR 11/12 (followed by the dose-to-risk conversion), Maine Yankee is agreeable to using the FGR-13 slope factors in the CRA (note: the CRA will include a comparison of the risks calculated directly with the FGR-13 values compared with calculating doses with FGR-11/12 followed by a dose-to-risk calculation). The state feels that the radionuclide risks will be slightly lower when using the FGR-13 factors directly.

Proposed resolution/action item: CH2M HILL and Maine Yankee will get back to DEP/BOH with a recommendation for how to present the radionuclide risk calculations – possibly use both methods for all of the survey areas, or only selected areas.

Methods for Selecting Exposure Units for Risk Estimation

The state requested that the CRA make the rationale for selection of overlapping areas between the RFI and FSS more transparent. The CRA should use smaller units of analysis in assessing cumulative risks, to facilitate the identification of areas where institutional controls may be needed (in other words, tabulate chemical and radiological data by exposure area using the smallest possible comparable units of exposure).

Mike presented a preliminary analysis comparing the risks between the RFI/HHRA and the FSS. John Rendall described the differences in the sampling approaches between the RFI and the LTP – the RFI involved a more judgmental and focused sampling approach, with samples clustered around areas where potential releases has occurred. The FSS (conducted in accordance with the LTP) was a more statistically-based approach designed to characterize average concentrations within specified areas. The RFI sampling data was interpreted conservatively, applying the upper bound concentration (i.e. the upper confidence limit on the average concentration) to areas of the facility with no history of waste management or releases. When combining these results with the radionuclide risks

estimated from FSS data, the outcome is that the FSS data better shows the variability in risks across portions of the site (in other words, there are numerous survey units where the chemical risk estimate is the same number; the same risk estimate is being applied to multiple survey units). The state acknowledged this feature of the CRA, and suggested discussing this issue as an uncertainty in the CRA. A part of that uncertainty discussion could be figures overlaying RFI soil sampling locations onto FSS survey units.

Proposed resolution/action: Overlay FSS survey unit boundaries over RCRA investigation boundaries; for example, overlay FSS survey unit boundary figures (e.g., Final Status Survey FR0200 SU4 Reference Map) over RCRA exposure areas (i.e., Figure 5-1a and 5-1b). figures:

- Show overlay of boundaries
- Show distribution of data on separate figure (indicate sample type but strip station IDs)
- Add clear/transparent description of why areas were selected (including discussion of possible uncertainties regarding overlap between RCRA investigation area boundaries and FSS survey unit boundaries – for example, some survey units will fall into two different RCRA investigation areas.)
- As discussed previously, present risk estimates for individual FSS survey units (based on the preliminary analysis prepared by Mike Whitney)

Selection of Exposure Factors

In its comments, the state requested that the CRA use produce ingestion assumptions and cesium and cobalt soil-to-plant transfer factors consistent with EPA's 2000 Soil Screening Guidance. Mike Whitney presented side by side comparison of the estimated risks using the factors currently in the CRA (which were derived from NUREG-5512), and produce ingestion assumptions presented in guidance developed by the state. The overall risk results are not sensitive to the ingestion exposure factors, since external exposure is the dominant pathway.

Eric does not feel that the selection of the exposure factors is a critical issue, as long as the basis for the selection is clear and transparent (as shown in Mike's table).

Proposed resolution/action is to use the ingestion exposure factors from HHRA. The soil-to-plant transfer factors from EPA, 2000 (the radionuclide soil screening guidance) will be used in the CRA. Explain in the CRA the basis for using the uptake/transfer factors (i.e., taken from HHRA). Also, include a side-by-side comparison of risks using the ingestion exposure factors and soil-to-plant transfer factors that is consistent with the NUREG-5512 guidance, presented in an appendix.

Evaluation of Groundwater Risks

The state requested that groundwater risks be evaluated in the CRA without the assumptions that institutional controls are present. Maine Yankee proposes to calculate groundwater risks using currently available data (being compiled in an annual groundwater monitoring report this September). The assumption is that the current groundwater concentrations both for chemicals and radionuclides would be worst case. Groundwater risks for the chemicals have already been calculated in the HHRA, and would be

incorporated into the CRA. A trend analysis will be done in annual groundwater report – Joan requested that previous year trend analysis of groundwater concentrations be presented. The trend analysis will show the changes in concentrations and risk over time – the results from that trend analysis will be incorporated into the CRA.

An important point that will be noted in the CRA is that groundwater yields are very low and groundwater is brackish (high TDS), which reduces the suitability of groundwater as a drinking water supply.

Jim Connell gave an update on the detection of tritium and carbon-14 in one well (MW502). A reanalysis of a groundwater sample from the well concluded that the carbon-14 detection was a sampling and analytical artifact. The state initially reported high carbon-14 but they now believe that the analysis was influenced by high tritium. An independent lab analysis (accounting for high tritium) confirmed that carbon-14 is not elevated.

Evaluation of Risks at the Shoreline

The state requested that the CRA include the exposure pathway from shoreline biota (note: the shoreline is not part of facility)

The RFI/HHRA evaluated risks from biota but LTP/FSS did not include evaluation of shoreline, as it was not part of the license. A radiological assessment (the marine sampling study) was done offshore based on an agreement with Friends of the Coast. That assessment presented analytical results in sediments and biota, along with comparison with radionuclide levels in reference areas. The results from the marine sampling study were that no significant radiological impacts were present.

The proposed resolution/action: summarize the results from the assessment presented in the RFI, and radiological marine sampling study so CRA document is stand alone (tables, numbers, etc.). It is not necessary to do a reanalysis of risks specifically for the CRA, but to provide a description of the differences in the assumptions.

Appendix B
Cumulative Risk Assessment for the
Backlands, Maine Yankee Site

Introduction

This document presents the evaluation of cumulative risk for the Backlands portion of the Maine Yankee site. The Backlands includes approximately 641 acres of undeveloped land where no known industrial activity occurred. This area is located to the West of Bailey Cove, North of Old Ferry Road and bounded by Back River to the east. The boundaries of the Backlands is shown by the shaded areas in Figure 1. The land has been open and accessible to the general public and is bounded by residential landowners. This area consists of open fields, woodland and some shoreline property, which has been uninhabited and unfarmed since plant construction started in 1968. All buildings and structures formerly located at the Eaton Farm area of the Backlands were demolished in the fall of 2003. At that time, the two drinking water wells located at Eaton Farm were also closed in accordance with MDEP specifications. Included in the Backlands are electrical transmission lines, and a railroad spur used to transport materials to and from the facility (MYAPC, 2001; MYAPC, 2002; MYAPC, 2004).

A different approach to cumulative risk assessment has been taken for the Backlands than is planned for Bailey Point, given the nature of the activities in that area. Risks associated with non-radiological chemical constituents detected in the Backlands have been evaluated through site characterization activities, and have been addressed under RCRA closure. RCRA closure activities are documented in the Backlands RCRA Facility Investigation (RFI) Report (MYAPC, 2004). The Backlands RFI Report documents that chemical constituents are at background concentrations or below applicable MDEP risk based levels with the exception of groundwater in the vicinity of Relic Dump 2. Maine Yankee plans to monitor and restrict use of groundwater in the vicinity of Relic Dump 2 until risk based levels are achieved in accordance with an MDEP approved plan. Radionuclides have been addressed under the License Termination Plan (LTP) (MYAPC, 2002). As discussed below, historical information has been compiled documenting that there have been no releases of radionuclides to the Backlands area and that radioactivity measured in the Backlands is indistinguishable from background. Therefore, radionuclides in the Backlands will be addressed as part of naturally-occurring background. Since radionuclides are indistinguishable from background, as is chemical constituents for the majority of the Backlands, it is concluded that there is no cumulative risk attributable to Maine Yankee in the Backlands.

Evaluation of Radionuclide Contaminants

The approach taken to evaluate the radionuclide contaminants in the Backlands involved a historical information review, the conduct radiological measurements (qualitative and quantitative) and the statistical comparison of the Backlands to a reference area. The first step involved examining historical information relating to land use and radiological impacts, if any, on the Backlands. Radiological measurements were then taken in the backlands. These radiological measurements consisted of quantitative soil sampling data and qualitative surface scanning. These measurements were compared to measurements taken at a reference area chosen for the similarity of its site characteristics and its relatively remote location from the Backlands.

A Historical Site Assessment (HSA), prepared as part of the LTP, documented unscheduled radiological releases and monitoring results throughout the operating history of the Maine Yankee facility (S&W 1999, MYAPC 2002). The results of the HSA indicated that none of these releases would have resulted in residual radionuclide contamination in the Backlands area. In addition to the HSA, monitoring studies reported in Section 2 of the LTP (Attachment 2A) document that radiological levels in the Backlands show no evidence of plant-derived radionuclides in these areas.

The Backlands areas were incorporated into the Initial Characterization Survey (ICS) conducted in 1997 and 1998, prior to decommissioning of the facility (MYAPC, 2001; MYAPC, 2002). The results from this survey have been used to request early release of the Backlands. The results from the ICS have been used to demonstrate that radionuclide concentrations in soil in the Backlands are statistically indistinguishable from background.

Site Setting and Historical Information

The Backlands portion of the Maine Yankee property has been open and accessible to the general public and is bounded by residential land owners. This area is classified by the Maine Yankee License Termination Plan as "non-impacted". Non-impacted areas are defined in NUREG-1575 (Multi-Agency Radiation Survey & Site Investigation Manual, MARSSIM) as areas that "have no reasonable potential for residual contamination, no radiological impact from site operations."

The Backlands consists of open fields, woodland and some shoreline property which has been uninhabited and un-farmed since plant construction started in 1968. The geology and hydrology of the area has been described in detail in the LTP and Backlands RFI Report and is physically similar to the operating area of the site itself except for there being little or no surface soil disturbance (except for the rubble pile area on the ash pit access road) (MYAPC, 2002; MYAPC, 2004). Structures in the area generally predate the construction of the plant.

The land areas under consideration are approximately 0.25 miles or more from the Reactor Building and process buildings. No radioactive material was used or stored beyond the peninsula of Bailey Point. Based on a review of the documentation assembled in the

Historical Site Assessment, there were no routine or unscheduled releases of radioactive material that would have resulted in residual contamination of the area under consideration. Therefore, there is no reasonable potential for residual contamination in the area.

A Radiological Environmental Monitoring Program (REMP) was instituted prior to operation of the plant and continued throughout operation and decommissioning of the plant. Radiological measurements included thousands of gamma dose rate measurements, hundreds of air and water samples, and hundreds of food stuff and surface vegetation samples. Gamma dose rate measurements have shown no difference in dose rates between the area under discussion and the control areas further from the site. Bailey Farm well water had slightly lower tritium levels on average than the water supplies in the Wiscasset area. Precipitation tritium levels at local sampling stations (Eaton and Bailey Farms) were similar to the control station levels. Fruits and vegetables sampled at the Bailey Farm showed the presence of only K-40 and fallout-produced Cs-137. Grasses sampled at the Eaton and Bailey Farms showed only natural K-40 and fallout-produced nuclides during periods of atmospheric testing. Initial soil samples contained Cs-137 at levels consistent with published values for fallout activity. Samples taken during the intervening period had Cs-137 levels consistent with that which should have resulted from the decay of the initial 1970 sample activity. No other radionuclides of plant origin were detected in these areas.

Summary of Radionuclide Sampling and Analytical Data

On August 16, 2002, Maine Yankee submitted an application⁴ for amendment to its license to release these backlands from the jurisdiction of the license. This application was supplemented⁵ on November 19, 2001, and approved by the NRC in License Amendment No. 167 on July 30, 2002. In the supporting justification attached to the application, Maine Yankee reviewed the qualitative surface scans and the quantitative soil analysis results of the Initial Characterization Survey (ICS) to determine if the residual radioactivity, if any, in the backlands is indistinguishable from background and thereby supports the classification of "non-impacted".

Scans of the open land areas were performed to provide a qualitative assessment of the potential for residual levels of radioactive material. Drive-over gamma scan surveys were performed on accessible (approximately 10%) open land areas. Technicians performed walk over, manual scans in approximately 1% of the Backland areas inaccessible to the drive-over scans. These scans resulted in identifying one area with an elevated radiation level. Upon investigation, the elevated reading was found to be due to local increase in naturally occurring radiation.

Approximately 150 soil samples were collected in the Backlands. These soils samples were analyzed for the following plant derived nuclides: Mn-54, Co-57, Co-58, Co-60, Zn-65, Ag-110m, Sb-125, Cs-134, Cs-137, Eu-154, Eu-155, Am-241 and Cm-243. None of these nuclides gave positive indications above minimum detectable activity (MDA) except for Cs-

⁴ Maine Yankee Letter to USNRC dated August 16, 2001, "Early Release of Backlands (Combined), Proposed Change No. 211, Supplement No. 1, (MN-01-034)

⁵ Maine Yankee Letter to USNRC dated November 19, 2001, Early Release of Backlands (Combined), Proposed Change No. 211, Supplement No. 2, (MN-01-044)

137. Therefore, Cs-137 is the only identified radionuclide potentially associated with the Maine Yankee operations. Cs-137 is also associated with fallout from historic weapons testing.

At each soil sample location, exposure rate measurements were taken for qualitative comparison purposes.

In order to demonstrate that the radioactivity in the Backlands is indistinguishable from background, the Backlands radioactivity measurements must be compared to the radioactivity measurements in a background reference area. The background reference area chosen for the study was the Merrymeeting Airfield in Bowdoinham, Maine. This area is approximately 10 miles from the site and is unaffected by licensed radioactive material. The Airfield is located to the east-north-east of the plant, upwind of Maine Yankee by the prevailing easterly winds. An independent contractor hired by Maine Yankee (Gerber 1997) and a soil scientist representing the State of Maine (MDOA 2000) both confirmed the geological and soil characteristics of the Airfield to be similar. The soil scientist made this confirmation based upon a review of the NRCS Published Soil Survey and site field investigations. Drive over scans were conducted in the background reference area to document instrument readings and survey technicians performed exposure rate measurements with two different detectors for comparison purposes. These exposure rate measurements (7.2 uR/hr to 9.8 uR/hr) compared well with measurements taken offsite under the Radiological Environmental Monitoring Program (7.1 uR/hr to 12.0 uR/hr).

The demonstration that site radionuclides were indistinguishable from background was performed using MARSSIM Scenario B. In Scenario B, the null hypothesis is that the survey unit meets the release criterion (indistinguishable from background). Under Scenario B, the comparison of measurements in the reference area and survey unit is made using two nonparametric statistical tests: the Wilcoxon Rank Sum (WRS) test and the Quantile test. The WRS and Quantile tests are both used because each test detects different residual contamination patterns in the survey units. Because two tests are used, the Type I error rate, α , (normally set at 0.05) is halved, and set at 0.025, for the individual tests. Using the NUREG-1505 recommended α of 0.025 allows for the use of the look-up tables in NUREG-1505, for r and k values used in the Quantile test.

The WRS test is designed to determine whether or not a degree of residual radioactivity remains uniform throughout the survey unit. The Quantile test is designed to detect a patchy contamination pattern.

Table 1 contains the soil sample Cs-137 results for the background reference area. The background reference area consisted of area surrounding the Merrymeeting Airfield located approximately 10 miles from the site and was representative of site characteristics. The Kruskal-Wallis test was used to confirm that there was no significant difference in the mean background concentrations among potential reference areas.

Table 2 summarizes the results of the soil sample Cs-137 results for the backlands areas and compares them to the results for the background reference area. For each of the Backlands

areas, the results of the WRS test, where applicable⁶, and the Quantile test successfully demonstrated that the radioactivity in the areas was indistinguishable from background.

TABLE 1
Reference Area and Survey Unit Soil Sample Cs-137 Results pCi/g

Area Description	Min.	Median	Mean (Ave.)	Max.	Std. Dev. (1 Φ)	Number of Samples
Reference Areas - Merrymeeting Airfield						
Combined (wood, open & scrub)	0.09	0.38	0.42	1.40	0.21	50
Wood Land	0.10	0.44	0.47	0.91	0.24	10
Open Land (Hay Field)	0.10	0.40	0.38	0.55	0.12	30
Scrub Land	0.09	0.38	0.48	1.40	0.34	10
Survey Units - Backlands						
R1500* Ash Rd. Rubble Piles - Open Land	0.02	0.06	0.07	0.21	0.04	30
R1600 Eaton Farm - Combined	0.05	0.39	0.45	1.43	0.29	60
R1600 Eaton Farm - Open Land	0.05	0.35	0.35	0.61	0.15	30
R1600 Eaton Farm - Wood Land	0.17	0.46	0.56	1.43	0.36	30
R1700 North of Old Ferry R. - Combined	0.04	0.30	0.39	1.55	0.33	60
R1700 North of Old Ferry R. - Open Land	0.04	0.10	0.17	0.49	0.12	30
R1700 North of Old Ferry R. - Wood Land	0.15	0.59	0.61	1.55	0.33	30

* Disturbed open land area within R1700 North of Ferry Rd. (fill added since the time of fallout from historic weapons testing).

⁶ For area R-1500 Ash Rd. Rubble Piles, the maximum Cs-137 reading was less than the value known as the Upper Boundary of the Grey Region; therefore, the application of the WRS test was not necessary to demonstrate indistinguishability from background.

TABLE 2

Statistical Tests Employed to Demonstrate Radioactivity is Indistinguishable from Background

	Reference Areas			
	Combined	Wooded	Open	Scrub
Backlands Survey Areas				
R1500 Open (Disturbed)	Passed WRS & Quantile			
R1600 Combined	Passed WRS & Quantile			
R1600 Open			Passed WRS & Quantile	
R1600 Wooded		Passed WRS & Quantile**		Passed WRS & Quantile**
R1700 Combined	Passed WRS & Quantile			
R1700 Open			Passed WRS & Quantile	
R1700 Wooded		Passed WRS & Quantile**		Passed WRS & Quantile**

** Low number of reference area wooded and scrub samples make these comparisons of limited usefulness.

Evaluation of Chemical Contaminants

The Maine Yankee Backlands RCRA Facility Investigation (RFI) was conducted to support RCRA closure of the Backlands portion of the site, in advance of final closure of the facility as a whole (MYAPC, 2004). The sampling program in the RFI was based on the conceptual model that there had been no industrial activity in the Backlands, and that only a select number of locations within the area had the potential for environmental contamination. Specific areas where contamination was suspected to be present included the Ash Road Rubble Piles, the Eaton Farm leachfield and the Carriage House floor. In addition to these areas, several small residential "relic" dumps from former homesteads were found in the Backlands. Debris from these relic dumps were removed by Maine Yankee, and investigated during the RFI. Additionally, impacted soil was remediated, via removal, from two relic dumps, RD-2 and RD-12.

RCRA Investigation and closure activities are documented in detail in the Backlands RCRA Facility Investigation Report.

Description of the RFI Approach

The Maine Yankee Backlands RCRA Facility Investigation (RFI) field program was conducted from September 2001 through November 2002. The objectives of the Backlands RFI are to support RCRA closure of the Backlands portion of the Maine Yankee site in an expedited fashion in advance of final RCRA closure for the facility as a whole. The expedited completion of the Backlands will allow Maine Yankee to transfer ownership of this portion of the property prior to RCRA closure of the industrial portion of the facility.

For investigation purposes, the Backlands was divided into two study areas: Study Area 1 comprising all Maine Yankee property north of Old Ferry Road, and Study Area 2 the remaining property west of Bailey Cove/Young's Brook and south of Old Ferry Road.

The Backlands RFI program included the excavation of 29 test pits, the installation of 14 soil boring/bedrock cores, and completion of twelve monitoring wells. A total of 86 surface and subsurface soil samples and 27 groundwater samples were analyzed as part of the Backlands RFI program. The soil and groundwater samples were typically field screened and analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), pesticides, Target Analyte List (TAL) metals and extractable petroleum hydrocarbons (EPH) or diesel range organics (DRO).

The sampling program for the RFI was designed with a site conceptual model that recognized that no industrial activity had occurred within the Backlands, and that only a select number of locations within the area had the potential for environmental contamination. Using this site conceptual model, a series of reference locations were developed from which soil and groundwater samples were taken. The reference locations were incorporated to establish soil and groundwater quality across the Backlands area and the Maine Yankee site as a whole.

In addition to the soil and groundwater reference locations, specific samples were targeted for areas where environmental contamination potentially occurred. These locations included the rubble piles in Study Area 1, the Eaton Farm leachfield and the Carriage House floor in Study Area 2, and Relic Dumps 2 and 12 in Study Area 2.

Maine Yankee conducted site characterization following the removal of miscellaneous debris at 12 relic dump locations. The results from the post-removal soil screening and laboratory analysis indicated that all but two of the relic dumps were consistent with reference soils. Due to the elevated concentration of metals and organic compounds in shallow soils detected at Relic Dump 2, additional soil and groundwater characterization was conducted at that dump location. Following additional site characterization, soil remediation was completed at Relic Dump 2 in November 2002. Groundwater use will also be restricted in the vicinity of Relic Dump 2 until remedial goals have been achieved. Specifically, groundwater MEGs are exceeded for DRO, aluminum, manganese, and sodium. Groundwater use is being prohibited in the vicinity of Relic Dump 2 through the placement of a deed restriction. A second relic dump (Relic Dump 12) also had elevated concentrations of metals and organic compounds relative to reference soils in the post-removal soil sample. Based on the small size of the area, Maine Yankee implemented a focused soil removal followed by confirmatory sampling at Relic Dump 12.

Summary of the Chemical Contaminant Sampling and Analytical Data

Based on the field and laboratory results for the Backlands RFI program, the following conclusions have been developed for the Backlands:

- The previous understanding for the subsurface geology and hydrology in the Backlands was confirmed by the Backlands explorations. Glaciomarine soils were observed to occur in the overburden above bedrock. Bedrock in the Backlands consisted of biotite schist, migmatite, and granite/pegmatite. Thicker sections of glaciomarine soils occur within the low valley areas where the less competent schistose bedrock occurs. Borings encountered a thin veneer of glaciomarine soils along the ridges that are supported by the more competent granite/pegmatite bedrock. In some locations, a thin, silty till layer is observed between the glaciomarine soils and bedrock. Groundwater in the Backlands occurs as a continuous aquifer within the bedrock. Groundwater also occurs within the overburden in the thicker valley areas, but is typically absent in the thin overburden soils associated with the granite/pegmatite bedrock ridges.
- Low levels of VOCs, EPH, dieldrin and polynuclear aromatic hydrocarbons (PAHs) are associated with the fill material within the rubble piles located in Study Area 1. The PAHs are most likely related to the presence of asphalt pieces observed within the fill material. Three of the PAHs exceed the respective project action limits (PALs). The VOCs and EPH are consistent with a minimal fuel spill associated with the cutting up of stumps observed in the rubble material or debris from parking lots and roadways included in the rubble material. The observed chemical concentrations of VOCs, dieldrin and EPH do not exceed project action limits (PALs). The concentration of chemicals detected in the rubble pile soils has not impacted groundwater monitoring wells in the

rubble pile area, and the low levels of VOCs, dieldrin and EPH detected in soil will naturally biodegrade.

- The risk to human health for soil and groundwater constituents detected in the rubble piles has been evaluated with a focused risk assessment for residential exposure. The results indicate that there is no significant human health risk associated with the rubble piles. The rubble piles were graded and seeded in November 2003.
- The leachfield at Eaton farm did not have any organic compounds reported above project quantitation limits and the TAL metal concentrations are consistent with background reference locations. These results indicate that the leachfield has not received environmental contamination other than human sewerage and is not a source of contamination for surrounding soil or groundwater. Historic groundwater sampling results for the Eaton Farm drinking water well located near the leachfield indicate that the well is impacted with low levels of nitrate, sodium and chloride that are believed to originate from the leachfield.
- Soil from the Carriage House at Eaton Farm had low concentrations of petroleum-related chemicals including PAHs and EPH, but are below the PAH and EPH PALs. These contaminants were associated with a small oil stain on the Carriage House floor below which the soil sample was collected. Based on the detected PAHs and EPH and the visibly stained soil, the impacted soil was removed and disposed off-site in November 2002. Confirmatory samples of the residual soils were below appropriate cleanup guidelines and consistent with future residential landuse.
- In general, the reference surface and subsurface soil results indicate that the Backland soils have non-detect concentrations of target organic compounds and that TAL metal concentrations are consistent with published background data. One soil sample from the reference soil borings (MYRSSB03) did have a reported concentration of trichloroethene (TCE) in the 2 to 4-foot sampling depth. The TCE concentration is well below the PAL, and TCE was not detected in soil samples above or below the TCE-containing sample. Likewise, TCE was not detected in groundwater from RW-03, the monitoring well associated with the soil boring. To further assess the TCE detection in the soil sample, the laboratory analyzed two of the duplicate VOC samples taken in the field. Both of these samples had non-detect values reported for TCE. To further evaluate the TCE detection, the 2 to 4-foot soil interval was re-sampled and analyzed for VOCs. The laboratory results were non-detect for all VOCs. The additional analysis and re-sampling indicates that the reported TCE concentration of 290 µg/kg is not representative of site conditions.
- Approximately 390 cubic yards of soil was removed from Relic Dump 2. Results of risk characterization conducted on 11 confirmatory soil samples for Relic Dump 2 indicate that, except for background concentrations of iron and arsenic, non cancer risks are below 1.0 and carcinogenic risk levels are below 1×10^{-5} , consistent with future residential landuse. The confirmatory sampling also showed that the remedial action was successful in reducing the potential ecological risk to soil invertebrates, plants, and upper trophic receptors.

- Approximately 6.5 cubic yards of soil was removed at Relic Dump 12. Comparison of Relic Dump 12 confirmatory soil results to MDEP RAG guidelines demonstrates that, except for background arsenic levels, soil concentrations are consistent with residential exposure.
- Aside from groundwater in the Relic Dump 2 monitoring wells, groundwater across the site in both reference and monitoring wells is interpreted as having no target organic compounds reported above the project quantitation limits and having metal concentrations consistent with published background data. Except for groundwater associated with Relic Dump 2, Backlands groundwater is suitable for drinking.
- Quantitative risk characterization for Relic Dump 2 groundwater indicates that ingestion of groundwater creates unacceptable risk to human health due to the presence of DRO, aluminum, manganese and sodium at concentrations in excess of MEGs. The source for the elevated DRO and metals observed in groundwater was the shallow soil contamination associated with the historic dumping activities. The contaminated soil has been removed, and groundwater concentrations are expected to decrease with time. Maine Yankee plans to place restrictions on groundwater use around Relic Dump 2 and monitor groundwater around the former dump until groundwater concentrations decrease to appropriate risk-based levels.

RFI Conclusions – Potential Risks from Chemical Contaminants

The Backland area was investigated and localized soils remediation were performed in accordance with MDEP-approved remediation and confirmatory sampling plans as part of the RFI. Confirmatory samples of soil were collected and analyzed following remediation. The remaining soil was assessed for risk to human-health and the environment or compared to appropriate remediation standards, and is consistent with residential reuse of the land. Based on the data collected and/or risk assessment performed, the soil remaining at Relic Dumps 2 and 12 and the Eaton Farm Carriage House presents no significant risk to human health and the environment. The DRO and metals detected in groundwater samples at Relic Dump 2 exceed MEGs. Groundwater from Relic Dump 2 will be monitored in the future to show that source removal has effectively reduced constituents to levels consistent with MEGs.

Evaluation of Cumulative Risks

Evaluation of cumulative risks in the Backlands has been based on the available site characterization data both for radionuclides and chemical contaminants, on the findings submitted in support of a request for early release, and on the documentation submitted in accordance with a MDEP-approved remediation plan. Based on the findings of these studies, as presented above, it is concluded that there are no cumulative risks from combined occurrence of radionuclides and chemical contaminants in the Backlands area. Key points in evaluating the potential for cumulative risks are as follows:

- Detected radionuclides in the Backlands soils are indistinguishable from background concentrations. Therefore, risks from radionuclides detected in the Backlands are no different from normal background risks.
- There is no historical evidence that facility activities have resulted in residual radioactivity in the Backlands areas (MYAPC, 2001, MYAPC, 2002; S&W, 1999).
- Non-radiological chemical constituents in Backlands soils and groundwater are at background levels or below risk based levels in accordance with RCRA closure with the exception of groundwater in the vicinity of Relic Dump 2. Maine Yankee plans to monitor and restrict use of groundwater in the vicinity of Relic Dump 2 until risk based levels are achieved in accordance with an MDEP approved plan.

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Appendix C
The Independent Spent Fuel Storage
Installation and Cumulative Risk

Introduction

The purpose of this Appendix is to present information concerning the Maine Yankee Independent Spent Fuel Storage Installation (ISFSI) for the purpose of evaluating the impact of the facility on the cumulative risk associated with the Maine Yankee decommissioning.

Background

During the latter stages of development of the cumulative risk protocol, there was considerable discussion concerning treatment of the Maine Yankee ISFSI. Since the ISFSI operation was an ongoing concern, and was licensed and monitored in accordance with federal regulations, Maine Yankee did not plan to consider the impact of the ISFSI as part of the decommissioning cumulative risk assessment. Upon further review, it was agreed that Maine Yankee would present information on the licensing bases, operational radiation dose rates and programmatic controls that would allow the State to evaluate the impact of the ISFSI on the cumulative risk associated with the Maine Yankee decommissioning.

During the process of decommissioning the former nuclear power plant on Bailey Point, Maine Yankee licensed and built an Independent Spent Fuel Storage Installation (ISFSI) for the storage of spent nuclear fuel generated during the operation of the plant. Since the goal of the decommissioning was demolition of plant structures, including the Spent Fuel Building, it was necessary to remove the spent fuel that was stored in the Spent Fuel Pool. The ISFSI was constructed to provide safe storage of Maine Yankee spent fuel and Greater Than Class C (GTCC) waste from irradiated reactor internals until the Department of Energy (DOE) or another entity licenses and constructs a high-level waste disposal facility or temporary storage facility. The construction of the ISFSI began in November, 1999 and was completed in June of 2001. Fuel and waste loading and transfer was completed in February, 2004.

The ISFSI

As a holder of a Nuclear Regulatory Commission (NRC) license to possess a nuclear reactor under 10 CFR Part 50, Maine Yankee is authorized under the general license provisions of 10 CFR Part 72 to store spent nuclear fuel in a cask storage system that is approved by the NRC. Maine Yankee chose the NRC-approved NAC UMS® canister system for storage of spent fuel, and constructed a facility to house the storage system in accordance with regulatory requirements.

The ISFSI was constructed within the site boundary of the former nuclear power plant on Bailey point. The ISFSI is located approximately 1200 feet north of the former power plant in an open area that was previously used as a parking lot. The facility is designed and constructed to be only large enough for the existing licensed Maine Yankee spent fuel and GTCC waste. Maine Yankee will not store any spent fuel or GTCC waste from other generators, nor would Maine Yankee's license allow such storage. Upon completion of decommissioning of the power plant on Bailey Point in the spring of 2005, all site lands except the ISFSI will meet license termination criteria, and will be removed from the NRC license. Once all non-ISFSI lands are released, the NRC-licensed site boundary will apply only to the ISFSI, which will exist on a parcel of land 8.79 acres in area.

Spent nuclear fuel and GTCC waste is stored in 64 NAC multipurpose canister systems consisting of a massive outer concrete cylinder that provides protection and shielding for an inner stainless steel air-tight metal canister that contains the waste material. Any heat generated by the waste is cooled by way of natural convection and the storage system has no moving parts.

The canister systems are stored on 16 31-ft. square concrete storage pads, each holding four casks, inside a Protected Area (PA) surrounded by a 12-ft. high security fence. Additional security is provided by a second 8-ft. high nuisance fence outside the security fence with a 20-ft. wide isolation zone between the two fences. An earthen berm partially surrounds the facility to reduce visual impact. A Security/Operations building for equipment and staff is integral to the facility.

ISFSI Dose Restrictions

Federal regulations require ISFSI operators to establish operational limits and restrictions to ensure that members of the public are not exposed to radioactive effluents or direct radiation in amounts that would result in individual doses above federal limits. There are no radioactive effluents associated with the sealed canisters, therefore the only mode of exposure is via direct radiation from the facility. The regulations establish limits for normal and design basis accident events associated with the operation of an ISFSI. Dose limits applicable to the Maine Yankee ISFSI exist in 10 CFR Parts 20 and 72, and 40 CFR 190. These dose limits apply to members of the public outside of a controlled area boundary, in areas where the licensee does not limit access or exercise authority over use of the area by the public. The dose limit in 10 CFR 72.104 for normal operation of the ISFSI is 25 mrem per year. The 40 CFR 190 dose limit for all licensed activities associated with the uranium fuel cycle is also 25 mrem per year.

For the purposes of meeting security obligations under 10 CFR Part 73 related to protection from the design basis threat of radiological sabotage, Maine Yankee has committed to a controlled area boundary of 300 meters, or 984 feet (Reference 2). The basis for this boundary is documented in a safeguards analysis performed by the NRC and their contractors of the potential consequences of a successful incidence of radiological sabotage. The dose objectives of §72.106 were used by the NRC as limiting criteria.

For the Maine Yankee ISFSI, the 300 meter security controlled area is adequate to ensure that all federal dose objectives are met. Controlled area boundaries established for the purpose of compliance with 10 CFR 20.1301, 10 CFR 72.104 and 40 CFR 190 dose objectives would exist considerably closer to the ISFSI than 300 meters and are therefore bounded by the security controlled area. For the duration of ISFSI operation on Bailey Point, Maine Yankee must own, control or otherwise exercise authority over the area within the 300 meter controlled area boundary for the purpose of meeting security and radiation protection obligations.

Access to the land inside the controlled area around the Maine Yankee ISFSI is limited to occupational workers who are monitored for exposure to radiation in accordance with federal standards, and to short duration visits by members of the public who have a need to access the area to perform specific tasks, such as maintenance and monitoring activities. Access to surface water or shoreline inside the 300 meter boundary for recreational or commercial harvesting activities is limited to the area east of the ISFSI on or in the vicinity of the Back River. Maine Yankee has performed radiological monitoring demonstrating that there will be no radiation exposure from routine ISFSI operations to members of the public participating in these activities. The results of the monitoring campaign are described in the following section.

ISFSI Neutron/Gamma Surveys

In order to assess the radiological impact of ISFSI operation and determine compliance with federal dose limits, Maine Yankee contracted with Radiation Safety & Control Services, Inc. (RSCS) to perform neutron and gamma dose rate surveys in the vicinity of the ISFSI (Reference 1). Initial surveys were performed on the partially loaded facility at approximately 40%, 60%, and 80% of capacity, and a final survey was performed in March and April of 2004 of the fully operational facility at 100% capacity.

During the week of March 29th, 2004, final gamma and neutron dose surveys were performed in and around the fully loaded ISFSI. Gamma exposure rates were measured at 169 locations and neutron radiation levels were measured at 55 locations around the ISFSI. The measurements were used to determine the distance from the center of the ISFSI to locations corresponding to a potential dose to a member of the public of 25 mrem per year, the 72.104 and 40 CFR 190 federal dose limits for normal ISFSI operations. The 25 mrem/year dose assumes a full-time occupancy by a member of the public of 8760 hours per year. The results were corrected for pre-load ISFSI ambient background and expressed as "Net Exposure" in the RSCS report. A total dose equivalent rate profile including both gamma and neutron dose was determined for the long (north-south) and short (east-west) ISFSI axes. The boundary determinations are summarized below:

Table 1
Estimated 25 mrem/year Boundary - ISFSI Dose Assessment

Boundary	Axis	Distance to 25 mrem/yr from center of ISFSI (ft)
South	Long	-379.8
North	Long	357.6
West	Short	-441.4
East	Short	321.5

As can be seen from the table above, the estimated boundary for compliance with federal dose limits for normal operation are well within the 984 ft. security controlled area boundary.

Distances from the center of the ISFSI corresponding to zero dose - and therefore zero risk - were determined by inspection of gamma and neutron survey data in order to determine locations where results indicated dose rates at or below background levels. For gamma measurements, net exposure rate results that are less than the product of 2 times the standard deviation are considered non-detects. Negative gamma exposure rate results are observed where the measured exposure rate was less than the pre-operational exposure rate. Gamma exposure rate measurements determined to be at or below background levels, i.e., corresponding to zero dose rate, are listed in the table below:

TABLE 2
Gamma Dose Rate Measurements at or Below Background

Measurement Location	Northing (ft)	Easting (ft)	Net Exposure Rate (uR/hr)	Net 2-sigma Uncert. (uR/hr)
68	623981.3	408555.5	0.4	0.6
69	623974.4	409233.7	0.1	0.5
70	623834.9	409422.1	-0.1	-0.6
71	624393.1	409596.5	-0.9	-0.6
72	624260.5	409854.7	-1.3	-0.6
76	624543.1	408253.6	-1.0	-0.6
77	624856.2	408709.0	-0.6	-0.3
78	624970.1	408550.0	-2.0	-0.4
79	625262.0	409254.7	-2.0	-0.3
107	623635.8	408279.1	0.0	0.5
111	624874.4	409387.2	-2.2	-0.7
112	625383.8	409436.0	-2.2	-0.5
113	624881.4	409945.3	-1.5	-0.6
130	623944.7	408031.2	-0.7	-0.6
131	624434.0	407769.7	-0.2	-0.6
162	624886.3	409113.5	0.3	0.6
195	624102.4	408305.2	0.5	0.4
196	623835.0	408806.5	-0.9	-0.6

All of the gamma dose rate measurements in Table 2 are either negative or less than the 2-sigma uncertainty, with the exception of measurement location 195, south of the ISFSI. The measurement at location 195 was considered background since the result was only 0.1 uR/hr above the 2-sigma uncertainty, and the location of the zero dose boundary through this geographic location is consistent with other measurement results to the east, west and south of position 195.

Figure 1 shows the location of gamma measurements corresponding to background levels, with a best fit line indicating the zero-dose boundary. Note that this boundary is well within the 300 meter boundary controlled by Maine Yankee. Also note that the zero dose boundary is located west of the Back River shoreline, indicating that commercial or recreational use of the Back River and shore in the vicinity of Maine Yankee will not present any risk to a member of the public.

Neutron dose rate measurements at or below background levels are shown on Table 3. Negative values indicate neutron dose rates less than a control measurement taken at a considerable distance from the ISFSI, in the Dresden area. Dose rate values that are less than the uncertainty rate are considered non-detect.

TABLE 3

Neutron Dose Rate Measurements at or Below Background

Measurement Location	Northing (ft)	Easting (ft)	Neutron Dose Equiv. Rate (urem/hr)	Neutron Dose Equiv. Uncert. Rate (urem/hr)
5	624433.7	409026.5	0.74	2.22
12	624378.7	409056.3	-0.84	-2.31
58	624533.8	408652.5	2.99	3.15
121	624721.8	409150.3	0.53	1.85
128	624412.1	408579.8	-0.63	-2.50
157	624845.0	408753.7	-1.27	-2.13
160	624771.5	409231.3	1.38	2.79
170	624262.6	409162.4	-0.22	-2.31
173	624332.0	409099.2	0.92	1.82
182	624431.8	408754.9	0.08	2.55

The neutron dose rate measurements in Table 3 indicate zero dose rate levels to the north, south, east and west of the ISFSI well within the gamma zero dose rate boundary.

The Controlled Area

As required by federal regulations, Maine Yankee must own or control a 300-meter controlled area around the ISFSI for the purposes of meeting radiation protection and security obligations. For the duration of ISFSI operations on Bailey Point, full-time residence by members of the public will not be allowed within the controlled area boundary.

Although full-time residence will not be allowed within the controlled area boundary, recreational and commercial use of the Back River water and shoreline adjacent to the ISFSI will only be restricted in the event of an emergency. Although considered a practical impossibility, members of the public could reside full-time on the Back River shoreline immediately west of the ISFSI and be completely unimpacted by normal ISFSI operation.

Members of the public may enter the controlled area boundary occasionally to perform maintenance or monitoring tasks such as snow removal or groundwater monitoring. Dose to members of the public from such visits is limited by federal regulations, as previously noted. Such access will be infrequent and of short duration, and is generally expected to result in no measurable dose to individual members of the public from the ISFSI.

The controlled area in the vicinity of the ISFSI is monitored by armed security personnel. Access to the controlled area boundary for reasons other than official business, other than access to the Back River shoreline area noted above, will not be permitted.

Conclusion

The Maine Yankee ISFSI meets all federal regulations for protection of members of the public. In accordance with federal regulations, Maine Yankee must own or control the area in the vicinity of the ISFSI corresponding to a 300 meter boundary outside the fuel canister storage area. The operation of the ISFSI will not contribute to cumulative risk from the Maine Yankee decommissioning, since there will be no impact to members of the public from normal ISFSI operations outside of the 300 meter controlled area boundary. In addition, there will be no impact to members of the public who may occasionally be involved in commercial or recreational activities on or near the Back River shoreline in the vicinity of the ISFSI inside of the 300 meter boundary.

References

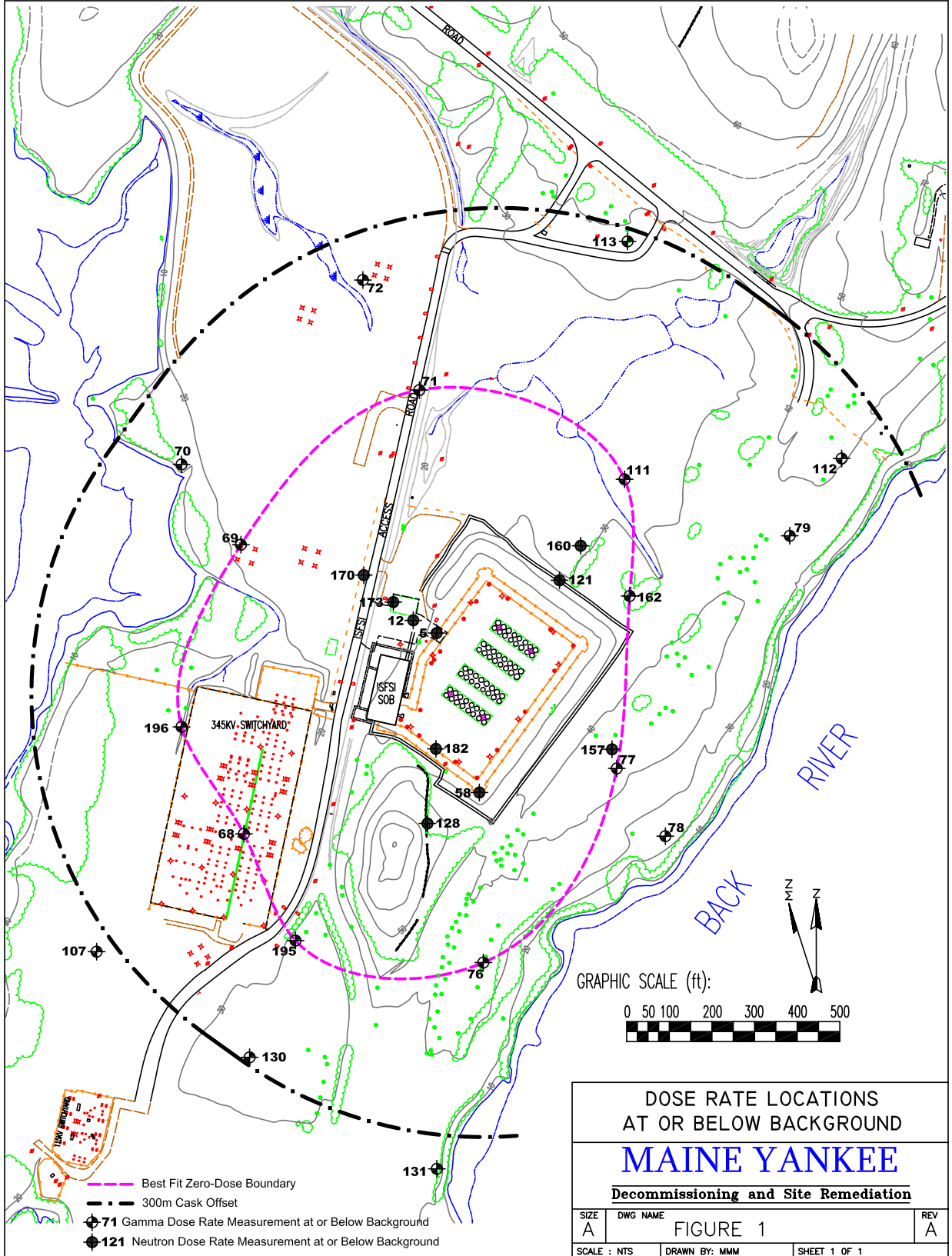
“Report, ISFSI Neutron/Gamma Survey in Support of Maine Yankee Atomic Power Company”, Radiation Safety & Control Services, Inc., October 25, 2004.

Letter from Michael K. Webb, Nuclear Regulatory Commission, to Michael Meisner, Maine Yankee, “Maine Yankee Atomic Power Company – Issuance of Amendment and Exemption From Requirements of 10 CFR 73.55”, July 25, 2001.

Title 10, Code of Federal Regulations.

Title 49, Code of Federal Regulations.

Maine Yankee Atomic Power Station Defueled Safety Analysis Report, Appendix B, as amended.



Appendix D
Comparison of Produce Ingestion Risks from
Radionuclides with Different Parameters

TABLE D-1

Comparison of Produce Ingestion Risks from Radionuclides with Different Parameters
 Side-by-Side Comparison of Parameters (Example for Survey Unit SU26)
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Parameter	Units	MYAPC, 2004 HHRA ¹	Description	NUREG CR-5512 ²	Description	USEPA SSG Radionuclides ³	Description
I _f	kg/yr	7.7	Exposed fruit and vegetables (exposed produce) ingestion rate	46	Fruit (exposed produce) ingestion rate		Fruit (exposed produce) ingestion rate - no separate value presented in EPA, 2000.
I _v	kg/yr	18.1	Protected vegetables & root produce ingestion rate	51	Vegetable (protected/root produce) ingestion rate	42.7	Vegetable ingestion rate - EPA, 2000 groups fruit and vegetable ingestion together, except leafy vegetables.
I _{lv}	kg/yr		Leafy vegetable ingestion rate	11	Leafy vegetable ingestion rate	4.66	Leafy vegetable ingestion rate
CPF	unitless	1	Contaminated plant fraction from site	1	Contaminated plant fraction from site	1	Contaminated plant fraction from site
ED	years	30	Exposure Duration	70	Exposure Duration - NUREG/CR-5512 does not include a value for this assumption. For purposes of comparison with EPA methodologies, the resident farmer scenario is assumed to use a 70 year exposure duration.	30	Exposure Duration
B _f	unitless	nuclide-specific	Soil-to-plant transfer coefficient, for fruit and leafy vegetables - converted to fresh weight basis	nuclide-specific	Soil-to-plant transfer coefficient, for fruit - converted to fresh weight basis	nuclide-specific	Soil-to-plant transfer coefficient, for fruit - converted to fresh weight basis
B _v	unitless	nuclide-specific	Soil-to-plant transfer coefficient, for protected & root vegetables	nuclide-specific	Soil-to-plant transfer coefficient, for protected/root vegetables	nuclide-specific	Soil-to-plant transfer coefficient, for protected/root vegetables
B _{lv}	unitless	nuclide-specific	Soil-to-plant transfer coefficient, for leafy vegetables - not used in this methodology	nuclide-specific	Soil-to-plant transfer coefficient, for leafy vegetables	nuclide-specific	Soil-to-plant transfer coefficient, for leafy vegetables
CSF		nuclide-specific	Cancer slope factor	nuclide-specific	Cancer slope factor	nuclide-specific	Cancer slope factor

Radionuclide		Description
Cs-137	Co-60	
3.74E-11	2.23E-11	Cancer Slope Factor (pCi) ⁻¹
Soil-to-plant transfer coefficient		
MYAPC, 2004 HHRA Methodology¹		
0.04	0.08	Exposed fruit & vegetables
0.04	0.08	Protected produce and root vegetables
-	-	Leafy vegetables (ingestion rate is grouped with exposed fruits and vegetables)
NUREG CR-5512 Methodology²		

TABLE D-1

Comparison of Produce Ingestion Risks from Radionuclides with Different Parameters
 Side-by-Side Comparison of Parameters (Example for Survey Unit SU26)
Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

0.0396	0.00126	Fruit
0.01225	0.01	Root vegetables
0.026	0.0162	Leafy vegetables
		USEPA SSG for Radionuclides³
-	-	Fruit
0.04	0.08	Fruits and vegetables
0.04	0.08	Leafy vegetables

NUREG CR-5512 (see Note 4)	Soil-to-plant transfer coefficient dry-weight basis		
Radionuclide	Soil-to-plant transfer coefficient - fruit	Soil-to-plant transfer coefficient - root vegetables	Soil-to-plant transfer coefficient - leafy vegetables
Cs-137	0.22	0.049	0.13
Co-60	0.007	0.04	0.081
	Soil-to-plant transfer coefficient wet-weight basis		
Conversion Factor ⁵	0.18	0.25	0.2
Radionuclide	Soil-to-plant transfer coefficient - fruit	Soil-to-plant transfer coefficient - root vegetables	Soil-to-plant transfer coefficient - leafy vegetables
Cs-137	0.0396	0.01225	0.026
Co-60	0.00126	0.01	0.0162

Notes:

1. MYAPC, 2004 HHRA Methodology
2. NUREG CR-5512 Methodology
3. USEPA Soil Screening Guidance for Radionuclides
4. The soil to plant transfer factors in NUREG/CR-5512 are estimates of uptake on dry-weight plant basis. Produce ingestion is estimates on a fresh-weight (wet-weight) basis. Therefore, the transfer factors are corrected using a dry-to-wet
5. Dry-to-wet weight conversion factor

TABLE D-2

Comparison of Produce Ingestion Risks from Radionuclides with Different Parameters
 Example Calculations: Survey Unit SU26, Survey Area FR0400, Exposure Unit 8
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Estimation of Total Dose and Risk from Crop Ingestion from Radionuclides, Onsite Resident Exposure Scenario, (FGR-13/HEAST Methodology

$$\text{Intake}_{ci} = C_e \times [(IR_f \times B_f) + (IR_v \times B_v) + (IR_{lv} \times B_{lv})] \times 1000 \times \text{CPF} \times \text{ED}$$

$$\text{ILCR} = \text{Intake}_{ci} \times \text{CSF}$$

MYAPC, 2004 HHRA Methodology ¹								
Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Soil-to-plant transfer coefficient fruit & leafy vegetables	Soil-to-plant transfer coefficient protected & root vegetables	Soil-to-plant transfer coefficient leafy vegetables	Intake Rate (pCi)	Cancer Slope Factor (pCi) ⁻¹	Increased Lifetime Cancer Risk
Cs-137	1.24E-01	8.96E-02	0.04	0.04		2.77E+03	3.74E-11	1.04E-07
Co-60	5.45E-01	1.36E-01	0.08	0.08		8.39E+03	2.23E-11	1.87E-07

NUREG CR-5512 Methodology ²								
Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Soil-to-plant transfer coefficient fruit	Soil-to-plant transfer coefficient root vegetables	Soil-to-plant transfer coefficient leafy vegetables	Intake Rate (pCi)	Cancer Slope Factor (pCi) ⁻¹	Increased Lifetime Cancer Risk
Cs-137	1.24E-01	8.96E-02	0.0396	0.01225	0.026	1.71E+04	3.74E-11	6.41E-07
Co-60	5.45E-01	1.36E-01	0.00126	0.01	0.0162	7.08E+03	2.23E-11	1.58E-07

USEPA Soil Screening Guidance for Radionuclides ³								
Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Soil-to-plant transfer coefficient fruit	Soil-to-plant transfer coefficient root vegetables	Soil-to-plant transfer coefficient leafy vegetables	Intake Rate (pCi)	Cancer Slope Factor (pCi) ⁻¹	Increased Lifetime Cancer Risk
Cs-137	1.24E-01	8.96E-02		0.04	0.04	5.09E+03	3.74E-11	1.90E-07
Co-60	5.45E-01	1.36E-01		0.08	0.08	1.54E+04	2.23E-11	3.43E-07

Summary of Risks by Methodology

Radionuclide	Estimated Cancer Risk by Exposure Pathway				Percent of External Exposure Risks		
	External Exposure	Produce Ingestion			Produce Ingestion		
		MYAPC, 2004	NUREG CR-5512	USEPA Soil Screening Guidance	MYAPC, 2004	NUREG CR-5512	USEPA Soil Screening Guidance
Cs-137	2.05E-06	1.04E-07	6.41E-07	1.90E-07	5.07%	31.30%	9.30%
Co-60	1.51E-05	1.87E-07	1.58E-07	3.43E-07	1.24%	1.05%	2.28%

Notes:

1. MYAPC, 2004 HHRA Methodology
2. NUREG CR-5512 Methodology
3. USEPA Soil Screening Guidance for Radionuclides
11/18/2006

Appendix E
Cumulative Risk Assessment Calculations -
Soil

Contents - Cumulative Risk Assessment Calculations - Soils

Table Number	Title	Notes
Table E-1	Exposure Unit Summary	Index of chemical and radionuclide exposure unit designations
Table E-2a	Statistics and Concentrations of Radionuclides	
Table E-2b	Estimate of Decay Adjustment	
Table E-2c	Summary of Constituents Of Potential Concern in Soil	
Table E-3	Estimation of Total Dose and Risk from Radionuclides, Onsite Resident Exposure Scenario - Dose to Risk Methodology	Presents estimated radionuclide risks calculated using dose conversion factors from FGR-11 and 12 guidance and a dose-to-risk conversion factor. Risks are summed across multiple pathways; calculations for individual pathways can be found in Tables E-4 through E-6.
Table E-4	Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Onsite Resident Exposure Scenario, (FGR-11 Dose to Risk Methodology)	
Table E-5	Estimation of Total Dose and Risk from Crop Ingestion from Radionuclides, Onsite Resident Exposure Scenario, (FGR-11 Dose to Risk Methodology)	
Table E-6	Estimation of Total Dose and Risk from External Exposure from Radionuclides, Onsite Resident Exposure Scenario, (FGR12 Dose-to-Risk Methodology)	

Contents - Cumulative Risk Assessment Calculations - Soils

Table Number	Title	Notes
Table E-7	Estimation of Total Dose and Risk from Radionuclides, Onsite Worker Exposure Scenario, (FGR11 Dose-to-Risk Methodology)	Presents estimated radionuclide risks calculated using dose conversion factors from FGR-11 and 12 guidance and a dose-to-risk conversion factor. Risks are summed across multiple pathways; calculations for individual pathways can be found in Tables E-8 and E-9.
Table E-8	Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Onsite Worker Exposure Scenario, (FGR11 Dose-to-Risk Methodology)	
Table E-9	Estimation of Total Dose and Risk from External Exposure from Radionuclides, Onsite Worker Exposure Scenario, (FGR12 Dose-to-Risk Methodology)	
Table E-10	Estimation of Total Dose and Risk from Radionuclides, Construction Worker Exposure Scenario, (FGR 11/12 Dose-to-Risk Methodology)	Presents estimated radionuclide risks calculated using dose conversion factors from FGR-11 and 12 guidance and a dose-to-risk conversion factor. Risks are summed across multiple pathways; calculations for individual pathways can be found in Tables E-11 and E-12.
Table E-11	Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Construction Worker Exposure Scenario, (FGR11 Dose-to-Risk Methodology)	
Table E-12	Estimation of Total Dose and Risk from External Exposure from Radionuclides, Construction Worker Exposure Scenario, (FGR12 Dose-to-Risk Methodology)	
Table E-13	Estimation of Total Dose and Risk from Radionuclides, Onsite Resident Exposure Scenario, (FGR13/HEAST Methodology)	Presents estimated radionuclide risks calculated using cancer slope factors based on FGR13 guidance. Risks are summed across multiple pathways; calculations for individual pathways can be found in Tables E-14 through E-16.

Contents - Cumulative Risk Assessment Calculations - Soils

Table Number	Title	Notes
Table E-14	Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Onsite Resident Exposure Scenario, (FGR13/HEAST Slope Factor Methodology)	
Table E-15	Estimation of Total Dose and Risk from Crop Ingestion from Radionuclides, Onsite Resident Exposure Scenario, (FGR-13/HEAST Methodology)	
Table E-16	Estimation of Total Dose and Risk from External Exposure from Radionuclides, Onsite Resident Exposure Scenario, (FGR13/HEAST Methodology)	
Table E-17	Estimation of Total Dose and Risk from Radionuclides, Onsite Worker Exposure Scenario, (FGR13/HEAST Methodology)	Presents estimated radionuclide risks calculated using cancer slope factors based on FGR13 guidance. Risks are summed across multiple pathways; calculations for individual pathways can be found in Tables E-18 and E-19.
Table E-18	Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Onsite Worker Exposure Scenario, (FGR13/HEAST Methodology)	
Table E-19	Estimation of Total Dose and Risk from External Exposure from Radionuclides, Onsite Worker Exposure Scenario, (FGR13/HEAST Methodology)	
Table E-20	Estimation of Total Dose and Risk from Radionuclides, Construction Worker Exposure Scenario, (FGR13/HEAST Methodology)	Presents estimated radionuclide risks calculated using cancer slope factors based on FGR13 guidance. Risks are summed across multiple pathways; calculations for individual pathways can be found in Tables E-21 and E-22.

Contents - Cumulative Risk Assessment Calculations - Soils

Table Number	Title	Notes
Table E-21	Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Construction Worker Exposure Scenario, (FGR13/HEAST Methodology)	
Table E-22	Estimation of Total Dose and Risk from External Exposure from Radionuclides, Construction Worker Exposure Scenario, (FGR13/HEAST Methodology)	
Table E-23	Excess Lifetime Cancer Risk (Radiological), All Scenarios - Comparison Between FGR 11/12 and FGR 13/HEAST Methodologies	
Table E-24	Radionuclide Exposure Point Concentrations	
Table E-25	Radionuclide Exposure Factors	
Table E-26	Total Chemical Carcinogenic Site Risks, Bailey Point RFI Report (MYAPC, 2004, Table 5-15)	
Table E-27	Cumulative Risks (Excess Lifetime Cancer Risk), All Scenarios, EU-1	
Table E-28	Cumulative Risks (Excess Lifetime Cancer Risk), All Scenarios, EU-2	
Table E-29	Cumulative Risks (Excess Lifetime Cancer Risk), All Scenarios, EU-3	
Table E-30	Cumulative Risks (Excess Lifetime Cancer Risk), All Scenarios, EU-4	
Table E-31	Cumulative Risks (Excess Lifetime Cancer Risk), All Scenarios, EU-5	
Table E-32	Cumulative Risks (Excess Lifetime Cancer Risk), All Scenarios, EU-6	
Table E-33	Cumulative Risks (Excess Lifetime Cancer Risk), All Scenarios, EU-7	
Table E-34	Cumulative Risks (Excess Lifetime Cancer Risk), All Scenarios, EU-8	

TABLE E-1
 Exposure Unit Summary
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Exposure Unit	Exposure Unit for Chemical Risks (RFI Investigation Area)	Exposure Unit for Radionuclide Risks (Final Status Survey)			
		Survey Unit Designation	Survey Area	Survey Unit	Survey Description
EU-1	Plant Area	SU01	FR0100	1	Yard West (2)
		SU02	FR0100	2	Yard West (2)
		SU03	FR0100	3	Yard West
		SU04	FR0111	8	Soil Remediation Areas
		SU05	FR0111	9	Soil Remediation Areas
		SU06	FR0111	10	Soil Remediation Areas
		SU07	FR0111	11	Soil Remediation Areas
		SU08	FR0111	12	Soil Remediation Areas
		SU09	FR0111	13	Soil Remediation Areas
		SU10	FR0111	14	Soil Remediation Areas
		SU11	FR0111	15	Soil Remediation Areas
		SU12	FR0111	16	Soil Remediation Areas
		SU13	FR0111	17	Soil Remediation Areas
		SU14	FR0111	18	Soil Remediation Areas
		SU15	FR0111	19	Soil Remediation Areas
		SU16	FR0111	20	Soil Remediation Areas
		SU17	FR0200	1	Yard East
		SU18	FR0200	2	Yard East
		SU19	FR0200	3	Yard East
		SU20	FR0200	4	Yard East
		SU21	FR0200	5	Yard East
		SU22	FR0200	6	Yard East
		SU23	FR0200	7	Yard East
		SU24	FR0200	8	Yard East
		SU25	FR0200	9	Yard East
		SU30	FR0500	1	Bailey Point
		SU31	FR0500	2	Bailey Point
		SU34	FR0900	1	BOP Land (Land South of 345 Yard & Little Oak Is)
		SU36	FR0900	3	BOP Land
		SU52	FA0400	1	Fuel Building Footprint
		EU-2	Warehouse 2/3	SU34	FR0900
SU47	FB1500			1	Warehouse 2/3
SU51	FB2600			1	Warehouse 5
EU-3	345 kV Transmission Line Area	SU40	FR1800	1	Bailey Land
		SU41	FR1800	2	Bailey Land
		SU43	FR2900	1	Final Grade, Rails, Roads: East Plant Access Road & adjoining parking lots and roads
		SU44	FR2900	2	Final Grade, Rails, Roads: West Access Rd & adjoining parking lots and roads
		SU45	FR2900	3	Final Grade, Rails, Roads (south & west) & Staff Bld Parking Lot, Lots E,C

TABLE E-1

Exposure Unit Summary
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Exposure Unit	Exposure Unit for Chemical Risks (RFI Investigation Area)	Exposure Unit for Radionuclide Risks (Final Status Survey)			
		Survey Unit Designation	Survey Area	Survey Unit	Survey Description
EU-4	Bailey House Area	SU40	FR1800	1	Bailey Land
		SU41	FR1800	2	Bailey Land
		SU42	FR1800	3	Bailey Land
		SU43	FR2900	1	Final Grade, Rails, Roads: East Plant Access Road & adjoining parking lots and roads
		SU49	FB1900	1	Bailey House Footprint
		SU50	FB2000	1	Bailey Barn Footprint
EU-5	Former Maintenance Truck Garage	SU40	FR1800	1	Bailey Land
EU-6	Parking Lot Area	SU32	FR0800	1	Admin and Parking Areas
		SU33	FR0810	1	Collection Site Sub Slab
		SU34	FR0900	1	BOP Land (Land South of 345 Yard & Little Oak Is)
		SU35	FR0900	2	BOP Land
		SU37	FR0900	4	BOP Land
		SU38	FR0910	1	Fire Pond
		SU41	FR1800	2	Bailey Land
		SU43	FR2900	1	Final Grade, Rails, Roads: East Plant Access Road & adjoining parking lots and roads
		SU44	FR2900	2	Final Grade, Rails, Roads: West Access Rd & adjoining parking lots and roads
		SU45	FR2900	3	Final Grade, Rails, Roads (south & west) & Staff Bld Parking Lot, Lots E,C
		SU46	FB1400	1	Information Center
SU48	FB1700	1	Staff Building		
EU-7	Foxbird Island	SU39	FR1000	0	Foxbird Island
EU-8	Forebay	SU03	FR0100	3	Yard West
		SU26	FR0400	1	Forebay Seal Pit Floor
		SU27	FR0400	2	Forebay Seal Pit Slopes
		SU39	FR1000	0	Foxbird Island

TABLE E-2a

Statistics and Concentrations of Radionuclides

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Area	Survey Unit	Survey Description	Mean Activity (pCi/g)		Number of Samples	Standard Deviation		Activity Corrected for Background (pCi/g)		Source Concentration in Soil for Risk Assessment (pCi/g)	
				Cs-137	Co-60		Cs-137	Co-60	Cs-137	Co-60	Cs-137	Co-60
SU01	FR0100	1	Yard West (2)	8.46E-02	0.00E+00	40	1.01E-01	0.00E+00	-1.05E-01	0.00E+00	0.00E+00	0.00E+00
SU02	FR0100	2	Yard West (2)	7.96E-02	5.08E-02	154	5.48E-02	1.52E-02	-1.10E-01	5.08E-02	0.00E+00	5.08E-02
SU03	FR0100	3	Yard West	9.70E-02	0.00E+00	43	1.71E-01	0.00E+00	-9.30E-02	0.00E+00	0.00E+00	0.00E+00
SU04	FR0111	8	Soil Remediation Areas	9.47E-02	0.00E+00	40	1.34E-01	0.00E+00	-9.53E-02	0.00E+00	0.00E+00	0.00E+00
SU05	FR0111	9	Soil Remediation Areas	7.68E-02	5.78E-02	43	5.22E-02	1.47E-02	-1.13E-01	5.78E-02	0.00E+00	5.78E-02
SU06	FR0111	10	Soil Remediation Areas	8.00E-02	7.18E-02	42	8.02E-02	8.35E-02	-1.10E-01	7.18E-02	0.00E+00	7.18E-02
SU07	FR0111	11	Soil Remediation Areas	1.20E-01	6.54E-02	40	1.15E-01	4.08E-02	-7.00E-02	6.54E-02	0.00E+00	6.54E-02
SU08	FR0111	12	Soil Remediation Areas	7.91E-02	6.05E-02	40	7.25E-02	2.44E-02	-1.11E-01	6.05E-02	0.00E+00	6.05E-02
SU09	FR0111	13	Soil Remediation Areas	6.69E-02	0.00E+00	40	1.53E-01	0.00E+00	-1.23E-01	0.00E+00	0.00E+00	0.00E+00
SU10	FR0111	14	Soil Remediation Areas	5.30E-02	5.23E-02	41	2.58E-02	2.45E-02	-1.37E-01	5.23E-02	0.00E+00	5.23E-02
SU11	FR0111	15	Soil Remediation Areas	6.04E-02	5.99E-02	42	1.89E-02	2.52E-02	-1.30E-01	5.99E-02	0.00E+00	5.99E-02
SU12	FR0111	16	Soil Remediation Areas	1.22E-01	7.92E-02	42	2.43E-01	7.97E-02	-6.80E-02	7.92E-02	0.00E+00	7.92E-02
SU13	FR0111	17	Soil Remediation Areas	8.21E-02	5.48E-02	40	1.29E-01	9.87E-03	-1.08E-01	5.48E-02	0.00E+00	5.48E-02
SU14	FR0111	18	Soil Remediation Areas	4.73E-02	0.00E+00	40	1.22E-02	0.00E+00	-1.43E-01	0.00E+00	0.00E+00	0.00E+00
SU15	FR0111	19	Soil Remediation Areas	6.30E-02	0.00E+00	40	4.82E-02	0.00E+00	-1.27E-01	0.00E+00	0.00E+00	0.00E+00
SU16	FR0111	20	Soil Remediation Areas	6.78E-02	8.66E-02	40	5.10E-02	2.13E-01	-1.22E-01	8.66E-02	0.00E+00	8.66E-02
SU17	FR0200	1	Yard East	9.69E-02	0.00E+00	14	1.40E-01	0.00E+00	-9.31E-02	0.00E+00	0.00E+00	0.00E+00
SU18	FR0200	2	Yard East	5.76E-02	0.00E+00	14	1.62E-02	0.00E+00	-1.32E-01	0.00E+00	0.00E+00	0.00E+00
SU19	FR0200	3	Yard East	5.12E-02	0.00E+00	42	1.31E-02	0.00E+00	-1.39E-01	0.00E+00	0.00E+00	0.00E+00
SU20	FR0200	4	Yard East	5.11E-02	5.43E-02	42	2.60E-02	2.03E-02	-1.39E-01	5.43E-02	0.00E+00	5.43E-02
SU21	FR0200	5	Yard East	5.19E-02	6.39E-02	52	1.89E-02	5.47E-02	-1.38E-01	6.39E-02	0.00E+00	6.39E-02
SU22	FR0200	6	Yard East	5.86E-02	5.93E-02	40	2.99E-02	2.76E-02	-1.31E-01	5.93E-02	0.00E+00	5.93E-02
SU23	FR0200	7	Yard East	5.80E-02	6.76E-02	42	3.21E-02	6.02E-02	-1.32E-01	6.76E-02	0.00E+00	6.76E-02
SU24	FR0200	8	Yard East	4.78E-02	5.49E-02	48	1.23E-02	2.54E-02	-1.42E-01	5.49E-02	0.00E+00	5.49E-02
SU25	FR0200	9	Yard East	6.53E-02	7.76E-02	45	5.56E-02	7.34E-02	-1.25E-01	7.76E-02	0.00E+00	7.76E-02
SU26	FR0400	1	Forebay Seal Pit Floor	3.14E-01	5.45E-01	16	5.09E-01	1.22E+00	1.24E-01	5.45E-01	1.24E-01	5.45E-01
SU27	FR0400	2	Forebay Seal Pit Slopes	9.77E-02	7.34E-02	19	1.18E-01	1.03E-01	-9.23E-02	7.34E-02	0.00E+00	7.34E-02
SU30	FR0500	1	Bailey Point	6.56E-02	0.00E+00	16	2.71E-02	0.00E+00	-1.24E-01	0.00E+00	0.00E+00	0.00E+00
SU31	FR0500	2	Bailey Point	4.16E-01	0.00E+00	14	5.01E-01	0.00E+00	2.26E-01	0.00E+00	2.26E-01	0.00E+00
SU32	FR0800	1	Admin and Parking Areas	6.37E-02	7.79E-02	14	3.76E-02	8.64E-02	-1.26E-01	7.79E-02	0.00E+00	7.79E-02
SU33	FR0810	1	Collection Site Sub Slab	5.90E-02	0.00E+00	14	3.00E-03	0.00E+00	-1.31E-01	0.00E+00	0.00E+00	0.00E+00
SU34	FR0900	1	BOP Land (Land South of 345 Yard & Little Oak Is)	2.03E-01	0.00E+00	19	3.96E-01	0.00E+00	1.30E-02	0.00E+00	1.30E-02	0.00E+00

TABLE E-2a

Statistics and Concentrations of Radionuclides

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Area	Survey Unit	Survey Description	Mean Activity (pCi/g)		Number of Samples	Standard Deviation		Activity Corrected for Background (pCi/g)		Source Concentration in Soil for Risk Assessment (pCi/g)	
SU35	FR0900	2	BOP Land	5.39E-02	0.00E+00	20	6.46E-03	0.00E+00	-1.36E-01	0.00E+00	0.00E+00	0.00E+00
SU36	FR0900	3	BOP Land	3.57E-01	0.00E+00	19	3.18E-01	0.00E+00	1.67E-01	0.00E+00	1.67E-01	0.00E+00
SU37	FR0900	4	BOP Land	7.63E-02	6.54E-02	14	2.53E-02	3.81E-02	-1.14E-01	6.54E-02	0.00E+00	6.54E-02
SU38	FR0910	1	Fire Pond	7.27E-02	7.72E-02	14	5.21E-03	6.66E-03	-1.17E-01	7.72E-02	0.00E+00	7.72E-02
SU39	FR1000		Foxbird Island	3.52E-01	2.69E-01	14	4.89E-01	3.37E-03	1.62E-01	2.69E-01	1.62E-01	2.69E-01
SU40	FR1800	1	Bailey Land	1.08E-01	0.00E+00	15	7.79E-02	0.00E+00	-8.20E-02	0.00E+00	0.00E+00	0.00E+00
SU41	FR1800	2	Bailey Land	2.31E-01	0.00E+00	15	2.22E-01	0.00E+00	4.10E-02	0.00E+00	4.10E-02	0.00E+00
SU42	FR1800	3	Bailey Land	1.18E-01	0.00E+00	16	3.50E-02	0.00E+00	-7.20E-02	0.00E+00	0.00E+00	0.00E+00
SU43	FR2900	1	Final Grade, Rails, Roads: East Plant Access Road & adjoining parking lots and roads	4.67E-02	0.00E+00	14	3.32E-03	0.00E+00	-1.43E-01	0.00E+00	0.00E+00	0.00E+00
SU44	FR2900	2	Final Grade, Rails, Roads: West Access Rd & adjoining parking lots and roads	5.79E-02	4.20E-02	14	8.92E-02	6.34E-02	-1.32E-01	4.20E-02	0.00E+00	4.20E-02
SU45	FR2900	3	Final Grade, Rails, Roads (south & west) & Staff Bld Parking Lot, Lots E,C	5.43E-02	0.00E+00	14	5.50E-03	0.00E+00	-1.36E-01	0.00E+00	0.00E+00	0.00E+00
SU46	FB1400	1	Information Center	5.26E-02	0.00E+00	14	5.60E-03	0.00E+00	-1.37E-01	0.00E+00	0.00E+00	0.00E+00
SU47	FB1500	1	Warehouse 2/3	4.26E-02	0.00E+00	14	5.51E-03	0.00E+00	-1.47E-01	0.00E+00	0.00E+00	0.00E+00
SU48	FB1700	1	Staff Building	8.26E-02	0.00E+00	14	4.95E-02	0.00E+00	-1.07E-01	0.00E+00	0.00E+00	0.00E+00
SU49	FB1900	1	Bailey House Footprint	4.60E-02	0.00E+00	14	1.10E-02	0.00E+00	-1.44E-01	0.00E+00	0.00E+00	0.00E+00
SU50	FB2000	1	Bailey Barn Footprint	2.40E-02	0.00E+00	14	4.33E-03	0.00E+00	-1.66E-01	0.00E+00	0.00E+00	0.00E+00
SU51	FB2600	1	Warehouse 5	2.72E-02	0.00E+00	14	7.90E-03	0.00E+00	-1.63E-01	0.00E+00	0.00E+00	0.00E+00
SU52	FA0400	1	Fuel Building Footprint	1.82E-01	1.33E-01	50	2.52E-01	1.97E-01	-8.00E-03	1.33E-01	0.00E+00	1.33E-01

Notes:

Survey resulting in the highest of the average concentrations measured within the survey area was used to provide the exposure point concentrations in the risk assessment.

Activities that are zero are either not detected or below background levels are treated as "zero" for purposes of evaluating cumulative risks.

Background level of Cs-137 developed from survey of Background Reference Area, FR9800

Activity Adjustments

Cs-137 Bkg (pCi/g)
1.90E-01

TABLE E-2b
 Estimate of Decay Adjustment
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

$$\frac{C_e}{C_o} = \frac{(1 - \exp(-k \times T))}{k \times T}$$

Parameter	Units	Value	Description
Ce	pCi/g	Calculated	Concentration in soil/groundwater/biota, integrated over exposure duration
Co	pCi/g	Scenario-specific	Initial concentration in soil/groundwater/biota (measured during site survey)
Ce/Co	unitless	Scenario-specific	Decay adjustment factor - measured concentrations are multiplied by this factor to obtain exposure concentrations
k	yr ⁻¹	Calculated	Radionuclide decay constant (calculated as 0.693/t _{1/2})
t _{1/2}	yr	Nuclide-specific	Radionuclide half life
T	yr	Scenario-specific	Exposure duration

Radionuclide	Scenario	Initial Concentration in Soil (pCi/g)	Half Life (yr)	Decay Constant (yr ⁻¹)	Exposure Duration (years)	Decay adjustment factor
Cs-137	Residential	1	30.17	2.30E-02	30	7.23E-01
Co-60	Residential	1	5.271	1.31E-01	30	2.49E-01
Cs-137	Worker	1	30.17	2.30E-02	25	7.61E-01
Co-60	Worker	1	5.271	1.31E-01	25	2.93E-01
Cs-137	Construction worker	1	30.17	2.30E-02	1	9.89E-01
Co-60	Construction worker	1	5.271	1.31E-01	1	9.37E-01

Source for this equation: Regulatory Guide 1.109 (NRC, 1977).

TABLE E-2c

Summary of Constituents Of Potential Concern in Soil¹

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Medium	Chemical	Minimum Conc. (mg/kg)	Maximum Conc. (mg/kg)	Location of Maximum	Detection Frequency	Average Concentration	95% UCL Concentration
Exposure Unit 1 - Plant Area							
Surface Soils							
	ARSENIC	4.6	22.3 J	MY05SB57(0-0.5)	39/39	7.7	8.6
	BENZO(A)PYRENE equivalent		22823				
	<i>BENZO(A)ANTHRACENE</i>	100 J	19000	MY05SS80 & SS95(0-0.5)	29/47	1779	
	<i>BENZO(A)PYRENE</i>	85 J	16000	MY05SS80 & SS95(0-0.5)	28/47	1632	
	<i>BENZO(B)FLUORANTHENE</i>	95 J	21000	MY05SS80 & SS95(0-0.5)	29/47	2030	
	<i>BENZO(K)FLUORANTHENE</i>	81 J	8400 J	MY05SS80 & SS95(0-0.5)	24/47	923	
	<i>DIBENZO(A,H)ANTHRACENE</i>	280 J	1750	MY05SS80 & SS95(0-0.5)	10/47	413	
	<i>CHRYSENE</i>	120 J	19000	MY05SS80 & SS95(0-0.5)	29/47	1737	
	<i>INDENO(1,2,3-CD)PYRENE</i>	190 J	9700	MY05SS80 & SS95(0-0.5)	22/47	1150	
Surface and Subsurface Soils							
	ARSENIC	2	22.3	MY05SB57(0-0.5)	52/53	7.7	8.6
	BENZO(A)PYRENE equivalent		22823				
	<i>BENZO(A)ANTHRACENE</i>	100	19000	MY05SS80 & SS95(0-0.5)	32/61	1446	
	<i>BENZO(A)PYRENE</i>	85	16000	MY05SS80 & SS95(0-0.5)	31/61	1327	
	<i>BENZO(B)FLUORANTHENE</i>	95	21000	MY05SS80 & SS95(0-0.5)	32/61	1634	
	<i>CHRYSENE</i>	110	19000	MY05SS80 & SS95(0-0.5)	32/61	1408	
	<i>DIBENZO(A,H)ANTHRACENE</i>	280	1750	MY05SS80 & SS95(0-0.5)	11/61	347	
	<i>BENZO(K)FLUORANTHENE</i>	81	8400	MY05SS80 & SS95(0-0.5)	27/61	768	
	<i>INDENO(1,2,3-CD)PYRENE</i>	190	9700	MY05SS80 & SS95(0-0.5)	24/61	941	

TABLE E-2c

Summary of Constituents Of Potential Concern in Soil¹

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Medium	Chemical	Minimum Conc. (mg/kg)	Maximum Conc. (mg/kg)	Location of Maximum	Detection Frequency	Average Concentration	95% UCL Concentration
Exposure Unit 2 - Warehouse 2/3							
Surface Soils							
	ARSENIC	2.1	16.6	MY05TP01(0-0.5)	8/8	9.3	13
	Total PCBs		2000				
	PCB-1254	1400	1400	MY05TP01(0-0.5)	1/16	96	266
	PCB-1260	150 J	600 J	MY05HA09(0-0.5)	3/16	82	169
	BENZO(A)PYRENE equivalent		5038.6				
	BENZO(A)ANTHRACENE	220 J	4200	MY05SS101	4/12	937	1728
	BENZO(A)PYRENE	200 J	3400	MY05SS101	4/12	777	1403
	BENZO(B)FLUORANTHENE	330 J	5300	MY05SS101	4/12	1188	2226
	BENZO(K)FLUORANTHENE	1000	2400	MY05SS101	3/12	543	943
	CHRYSENE	255 J	4600	MY05SS101	4/12	998	1856
	DIBENZO(A,H)ANTHRACENE	250 J	430	MY05SS101	3/12	223	264
	INDENO(1,2,3-CD)PYRENE	1100	2300	MY05SS101	3/12	559	964
Surface and Subsurface Soils							
	ARSENIC	2.1	16.8	MY05TP01(3-3.5)	19/19	8.7	11
	Total PCBs		2000				
	PCB-1254	52	1400	MY05TP01(0-0.5)	4/35	68	148
	PCB-1260	31 J	600 J	MY05HA09(0-0.5)	4/35	43	84
	BENZO(A)PYRENE equivalent		5039				
	BENZO(A)ANTHRACENE	220 J	4200	MY05SS101	4/39	423	683
	BENZO(A)PYRENE	200 J	3400	MY05SS101	4/39	374	579
	BENZO(B)FLUORANTHENE	180 J	5300	MY05SS101	5/39	500	843
	BENZO(K)FLUORANTHENE	1000	2400	MY05SS101	3/39	302	432
	CHRYSENE	255 J	4600	MY05SS101	4/39	442	724
	DIBENZO(A,H)ANTHRACENE	250 J	430	MY05SS101	3/39	203	217
	INDENO(1,2,3-CD)PYRENE	1100	2300	MY05SS101	3/39	307	439

TABLE E-2c

Summary of Constituents Of Potential Concern in Soil¹

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Medium	Chemical	Minimum Conc. (mg/kg)	Maximum Conc. (mg/kg)	Location of Maximum	Detection Frequency	Average Concentration	95% UCL Concentration
Exposure Unit 3 - 345 kV Transmission Line Area							
Surface Soils							
	ARSENIC	3.5	15.1	MY05SS109(0-0.5)	26/26	15.1	11
	BENZO(A)PYRENE equivalent		1128.5				
	<i>BENZO(A)ANTHRACENE</i>	207.5	1100	MY05SS12(0-0.5)	2/25	1100	304
	<i>BENZO(A)PYRENE</i>	217.5	860	MY05SS12(0-0.5)	2/25	860	277
	<i>BENZO(B)FLUORANTHENE</i>	202.5	1100	MY05SS12(0-0.5)	2/25	1100	304
	<i>BENZO(K)FLUORANTHENE</i>	350	350	MY05SS12(0-0.5)	1/25	350	219
	<i>CHRYSENE</i>	212.5	1000	MY05SS12(0-0.5)	2/25	1000	293
	<i>INDENO(1,2,3-CD)PYRENE</i>	440	440	MY05SS12(0-0.5)	1/25	440	229
Surface and Subsurface Soils							
	ARSENIC	3.5	16.2	MY05SB46(4-6)	49/49	16.2	12
	BENZO(A)PYRENE equivalent		1557				
	<i>BENZO(A)ANTHRACENE</i>	207.5	1100	MY05SS12(0-0.5)	4/48	1100	261
	<i>BENZO(A)PYRENE</i>	217.5	860	MY05SS12(0-0.5)	5/48	860	267
	<i>BENZO(B)FLUORANTHENE</i>	202.5	1100	MY05SS12(0-0.5)	5/48	1100	284
	<i>BENZO(K)FLUORANTHENE</i>	350	560	MY05TP107A(9-11)	4/48	560	239
	<i>CHRYSENE</i>	212.5	1000	MY05SS12(0-0.5)	3/48	1000	254
	<i>DIBENZO(A,H)ANTHRACENE</i>	420	420	MY05TP111A(9-11)	1/48	420	216
	<i>INDENO(1,2,3-CD)PYRENE</i>	360	560	MY05TP107A(9-11)	4/48	560	241
Exposure Unit 4 - Bailey Farmhouse							
Surface Soils							
	ARSENIC	7.2	7.2	MY05SB25(0-0.5)	1/1	7.2	NA
Surface and Subsurface Soils							
	ARSENIC	6.4	8.2	MY05SB25(2-8)	3/3	8.2	8.3

Note:

1. Those COPCs exceeding 1×10^{-6} cancer risk.

Data from Tables 5-1C through 5-1F, MYAPC, 2004.

TABLE E-3
 Estimation of Total Dose and Risk from Radionuclides, Onsite Resident Exposure Scenario - Dose to Risk Methodology
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Initial Concentration in Soil (pCi/g)	Exposure Concentration in Soil (pCi/g)	Total Dose Over Exposure Duration (mrem)				Excess Lifetime Cancer Risk				Radionuclide Excess Lifetime Cancer Risk
						Soil Ingestion	Crop Ingestion	External Exposure	Total	Soil Ingestion	Crop Ingestion	External Exposure	Total	
SU01	FR0100	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU02	FR0100	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.53E-06
SU03	FR0100	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU04	FR0111	8	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU05	FR0111	9	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.75E-06
SU06	FR0111	10	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.17E-06
SU07	FR0111	11	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.97E-06
SU08	FR0111	12	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.83E-06
SU09	FR0111	13	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU10	FR0111	14	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.58E-06
SU11	FR0111	15	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.81E-06
SU12	FR0111	16	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.39E-06
SU13	FR0111	17	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.65E-06
SU14	FR0111	18	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU15	FR0111	19	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU16	FR0111	20	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.61E-06
SU17	FR0200	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU18	FR0200	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU19	FR0200	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU20	FR0200	4	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.64E-06
SU21	FR0200	5	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.93E-06
SU22	FR0200	6	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.79E-06
SU23	FR0200	7	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.04E-06
SU24	FR0200	8	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.66E-06
SU25	FR0200	9	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.34E-06
SU26	FR0400	1	Cs-137	1.24E-01	8.96E-02	2.42E-03	1.92E-01	2.89E+00	3.08E+00	1.93E-09	1.53E-07	2.31E-06	2.47E-06	1.89E-05
SU27	FR0400	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.22E-06
SU30	FR0500	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU31	FR0500	2	Cs-137	2.26E-01	1.63E-01	4.41E-03	3.49E-01	5.27E+00	5.62E+00	3.52E-09	2.80E-07	4.21E-06	4.50E-06	4.50E-06
SU32	FR0800	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.35E-06
SU33	FR0810	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU34	FR0900	1	Cs-137	1.30E-02	9.39E-03	2.53E-04	2.01E-02	3.03E-01	3.23E-01	2.03E-10	1.61E-08	2.42E-07	2.59E-07	2.59E-07
SU35	FR0900	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU36	FR0900	3	Cs-137	1.67E-01	1.21E-01	3.26E-03	2.58E-01	3.89E+00	4.15E+00	2.60E-09	2.07E-07	3.11E-06	3.32E-06	3.32E-06
SU37	FR0900	4	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.97E-06
SU38	FR0910	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.33E-06
SU39	FR1000	0	Cs-137	1.62E-01	1.17E-01	3.16E-03	2.51E-01	3.78E+00	4.03E+00	2.53E-09	2.00E-07	3.02E-06	3.22E-06	1.13E-05
SU40	FR1800	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU41	FR1800	2	Cs-137	4.10E-02	2.96E-02	7.99E-04	6.34E-02	9.56E-01	1.02E+00	6.39E-10	5.07E-08	7.65E-07	8.16E-07	8.16E-07
SU42	FR1800	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU43	FR2900	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU44	FR2900	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.27E-06
SU45	FR2900	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU46	FB1400	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU47	FB1500	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU48	FB1700	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU49	FB1900	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU50	FB2000	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU51	FB2600	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU52	FA0400	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.02E-06
														1.89E-05 MAX

TABLE E-3
 Estimation of Total Dose and Risk from Radionuclides, Onsite Resident Exposure Scenario - Dose to Risk Methodology
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Initial Concentration in Soil (pCi/g)	Exposure Concentration in Soil (pCi/g)	Total Dose Over Exposure Duration (mrem)				Excess Lifetime Cancer Risk				Radionuclide Excess Lifetime Cancer Risk
						Soil Ingestion	Crop Ingestion	External Exposure	Total	Soil Ingestion	Crop Ingestion	External Exposure	Total	Total Risk
SU01	FR0100	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU02	FR0100	2	Co-60	5.08E-02	1.26E-02	1.84E-04	8.47E-02	1.83E+00	1.92E+00	1.47E-10	6.78E-08	1.47E-06	1.53E-06	
SU03	FR0100	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU04	FR0111	8	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU05	FR0111	9	Co-60	5.78E-02	1.44E-02	2.09E-04	9.64E-02	2.08E+00	2.18E+00	1.67E-10	7.71E-08	1.67E-06	1.75E-06	
SU06	FR0111	10	Co-60	7.18E-02	1.79E-02	2.60E-04	1.20E-01	2.59E+00	2.71E+00	2.08E-10	9.58E-08	2.07E-06	2.17E-06	
SU07	FR0111	11	Co-60	6.54E-02	1.63E-02	2.37E-04	1.09E-01	2.36E+00	2.47E+00	1.89E-10	8.73E-08	1.89E-06	1.97E-06	
SU08	FR0111	12	Co-60	6.05E-02	1.50E-02	2.19E-04	1.01E-01	2.18E+00	2.28E+00	1.75E-10	8.07E-08	1.75E-06	1.83E-06	
SU09	FR0111	13	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU10	FR0111	14	Co-60	5.23E-02	1.30E-02	1.89E-04	8.72E-02	1.89E+00	1.97E+00	1.51E-10	6.98E-08	1.51E-06	1.58E-06	
SU11	FR0111	15	Co-60	5.99E-02	1.49E-02	2.17E-04	9.99E-02	2.16E+00	2.26E+00	1.73E-10	7.99E-08	1.73E-06	1.81E-06	
SU12	FR0111	16	Co-60	7.92E-02	1.97E-02	2.86E-04	1.32E-01	2.86E+00	2.99E+00	2.29E-10	1.06E-07	2.29E-06	2.39E-06	
SU13	FR0111	17	Co-60	5.48E-02	1.36E-02	1.98E-04	9.14E-02	1.98E+00	2.07E+00	1.59E-10	7.31E-08	1.58E-06	1.65E-06	
SU14	FR0111	18	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU15	FR0111	19	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU16	FR0111	20	Co-60	8.66E-02	2.15E-02	3.13E-04	1.44E-01	3.12E+00	3.27E+00	2.51E-10	1.16E-07	2.50E-06	2.61E-06	
SU17	FR0200	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU18	FR0200	2	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU19	FR0200	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU20	FR0200	4	Co-60	5.43E-02	1.35E-02	1.96E-04	9.06E-02	1.96E+00	2.05E+00	1.57E-10	7.25E-08	1.57E-06	1.64E-06	
SU21	FR0200	5	Co-60	6.39E-02	1.59E-02	2.31E-04	1.07E-01	2.30E+00	2.41E+00	1.85E-10	8.53E-08	1.84E-06	1.93E-06	
SU22	FR0200	6	Co-60	5.93E-02	1.47E-02	2.14E-04	9.89E-02	2.14E+00	2.24E+00	1.72E-10	7.91E-08	1.71E-06	1.79E-06	
SU23	FR0200	7	Co-60	6.76E-02	1.68E-02	2.44E-04	1.13E-01	2.44E+00	2.55E+00	1.96E-10	9.02E-08	1.95E-06	2.04E-06	
SU24	FR0200	8	Co-60	5.49E-02	1.36E-02	1.99E-04	9.16E-02	1.98E+00	2.07E+00	1.59E-10	7.33E-08	1.58E-06	1.66E-06	
SU25	FR0200	9	Co-60	7.76E-02	1.93E-02	2.81E-04	1.29E-01	2.80E+00	2.93E+00	2.25E-10	1.04E-07	2.24E-06	2.34E-06	
SU26	FR0400	1	Co-60	5.45E-01	1.36E-01	1.97E-03	9.09E-01	1.97E+01	2.06E+01	1.58E-09	7.27E-07	1.57E-05	1.65E-05	
SU27	FR0400	2	Co-60	7.34E-02	1.82E-02	2.65E-04	1.22E-01	2.65E+00	2.77E+00	2.12E-10	9.79E-08	2.12E-06	2.22E-06	
SU30	FR0500	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU31	FR0500	2	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU32	FR0800	1	Co-60	7.79E-02	1.94E-02	2.82E-04	1.30E-01	2.81E+00	2.94E+00	2.25E-10	1.04E-07	2.25E-06	2.35E-06	
SU33	FR0810	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU34	FR0900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU35	FR0900	2	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU36	FR0900	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU37	FR0900	4	Co-60	6.54E-02	1.63E-02	2.37E-04	1.09E-01	2.36E+00	2.47E+00	1.89E-10	8.73E-08	1.89E-06	1.97E-06	
SU38	FR0910	1	Co-60	7.72E-02	1.92E-02	2.79E-04	1.29E-01	2.78E+00	2.91E+00	2.23E-10	1.03E-07	2.23E-06	2.33E-06	
SU39	FR1000	0	Co-60	2.69E-01	6.69E-02	9.73E-04	4.49E-01	9.70E+00	1.02E+01	7.78E-10	3.59E-07	7.76E-06	8.12E-06	
SU40	FR1800	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU41	FR1800	2	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU42	FR1800	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU43	FR2900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU44	FR2900	2	Co-60	4.20E-02	1.04E-02	1.52E-04	7.01E-02	1.52E+00	1.59E+00	1.22E-10	5.60E-08	1.21E-06	1.27E-06	
SU45	FR2900	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU46	FB1400	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU47	FB1500	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU48	FB1700	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU49	FB1900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU50	FB2000	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU51	FB2600	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU52	FA0400	1	Co-60	1.33E-01	3.31E-02	4.81E-04	2.22E-01	4.80E+00	5.02E+00	3.85E-10	1.77E-07	3.84E-06	4.02E-06	

TABLE E-4

Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Onsite Resident Exposure Scenario, (FGR-11 Dose to Risk Methodology)
Cumulative Risk Assessment
 Maine Yankee Facility, Wiscassett, ME

$$Intake_{si} = C_e \times IR_{si} \times 0.001 \times EF \times ED$$

$$Dose_{si} = Intake_{si} \times DCF_i$$

$$ILCR = Dose_{si} \times CF$$

Parameter	Units	Value	Description
Intake _{si}	pCi	Calculated	Radionuclide exposure through soil ingestion
C _e	pCi/g	Nuclide-specific	Exposure concentration in soil
IR _{si}	mg/day	120	Soil ingestion rate (0.001 g/mg is a conversion factor)
EF	days/year	150	Exposure frequency
ED	years	30	Exposure duration
DCF _i	mrem/pCi	Nuclide-specific	Dose conversion factor for ingestion (from FGR 11)
ILCR	unitless	Calculated	Increased lifetime cancer risk
CF	risk/mrem	8.00E-07	Dose to risk conversion factor

Radionuclide	Dose Conversion Factor (mrem/pCi)
Cs-137	5.00E-05
Co-60	2.69E-05

TABLE E-4

Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Onsite Resident Exposure Scenario, (FGR-11 Dose to Risk Methodology

*Cumulative Risk Assessment**Maine Yankee Facility, Wiscasset, ME*

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Dose Conversion Factor (mrem/pCi)	Total Dose (mrem)	Increased Lifetime Cancer Risk
SU01	FR0100	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU02	FR0100	2	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU03	FR0100	3	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU04	FR0111	8	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU05	FR0111	9	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU06	FR0111	10	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU07	FR0111	11	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU08	FR0111	12	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU09	FR0111	13	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU10	FR0111	14	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU11	FR0111	15	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU12	FR0111	16	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU13	FR0111	17	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU14	FR0111	18	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU15	FR0111	19	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU16	FR0111	20	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU17	FR0200	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU18	FR0200	2	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU19	FR0200	3	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU20	FR0200	4	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU21	FR0200	5	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU22	FR0200	6	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU23	FR0200	7	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU24	FR0200	8	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU25	FR0200	9	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU26	FR0400	1	Cs-137	1.24E-01	8.96E-02	5.00E-05	2.42E-03	1.93E-09
SU27	FR0400	2	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU30	FR0500	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU31	FR0500	2	Cs-137	2.26E-01	1.63E-01	5.00E-05	4.41E-03	3.52E-09
SU32	FR0800	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU33	FR0810	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU34	FR0900	1	Cs-137	1.30E-02	9.39E-03	5.00E-05	2.53E-04	2.03E-10
SU35	FR0900	2	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU36	FR0900	3	Cs-137	1.67E-01	1.21E-01	5.00E-05	3.26E-03	2.60E-09

TABLE E-4

Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Onsite Resident Exposure Scenario, (FGR-11 Dose to Risk Methodology

*Cumulative Risk Assessment**Maine Yankee Facility, Wiscasset, ME*

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Dose Conversion Factor (mrem/pCi)	Total Dose (mrem)	Increased Lifetime Cancer Risk
SU37	FR0900	4	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU38	FR0910	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU39	FR1000	0	Cs-137	1.62E-01	1.17E-01	5.00E-05	3.16E-03	2.53E-09
SU40	FR1800	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU41	FR1800	2	Cs-137	4.10E-02	2.96E-02	5.00E-05	7.99E-04	6.39E-10
SU42	FR1800	3	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU43	FR2900	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU44	FR2900	2	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU45	FR2900	3	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU46	FB1400	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU47	FB1500	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU48	FB1700	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU49	FB1900	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU50	FB2000	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU51	FB2600	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU52	FA0400	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU01	FR0100	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU02	FR0100	2	Co-60	5.08E-02	1.26E-02	2.69E-05	1.84E-04	1.47E-10
SU03	FR0100	3	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU04	FR0111	8	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU05	FR0111	9	Co-60	5.78E-02	1.44E-02	2.69E-05	2.09E-04	1.67E-10
SU06	FR0111	10	Co-60	7.18E-02	1.79E-02	2.69E-05	2.60E-04	2.08E-10
SU07	FR0111	11	Co-60	6.54E-02	1.63E-02	2.69E-05	2.37E-04	1.89E-10
SU08	FR0111	12	Co-60	6.05E-02	1.50E-02	2.69E-05	2.19E-04	1.75E-10
SU09	FR0111	13	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU10	FR0111	14	Co-60	5.23E-02	1.30E-02	2.69E-05	1.89E-04	1.51E-10
SU11	FR0111	15	Co-60	5.99E-02	1.49E-02	2.69E-05	2.17E-04	1.73E-10
SU12	FR0111	16	Co-60	7.92E-02	1.97E-02	2.69E-05	2.86E-04	2.29E-10
SU13	FR0111	17	Co-60	5.48E-02	1.36E-02	2.69E-05	1.98E-04	1.59E-10
SU14	FR0111	18	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU15	FR0111	19	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU16	FR0111	20	Co-60	8.66E-02	2.15E-02	2.69E-05	3.13E-04	2.51E-10
SU17	FR0200	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU18	FR0200	2	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00

TABLE E-4

Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Onsite Resident Exposure Scenario, (FGR-11 Dose to Risk Methodology

*Cumulative Risk Assessment**Maine Yankee Facility, Wiscasset, ME*

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Dose Conversion Factor (mrem/pCi)	Total Dose (mrem)	Increased Lifetime Cancer Risk
SU19	FR0200	3	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU20	FR0200	4	Co-60	5.43E-02	1.35E-02	2.69E-05	1.96E-04	1.57E-10
SU21	FR0200	5	Co-60	6.39E-02	1.59E-02	2.69E-05	2.31E-04	1.85E-10
SU22	FR0200	6	Co-60	5.93E-02	1.47E-02	2.69E-05	2.14E-04	1.72E-10
SU23	FR0200	7	Co-60	6.76E-02	1.68E-02	2.69E-05	2.44E-04	1.96E-10
SU24	FR0200	8	Co-60	5.49E-02	1.36E-02	2.69E-05	1.99E-04	1.59E-10
SU25	FR0200	9	Co-60	7.76E-02	1.93E-02	2.69E-05	2.81E-04	2.25E-10
SU26	FR0400	1	Co-60	5.45E-01	1.36E-01	2.69E-05	1.97E-03	1.58E-09
SU27	FR0400	2	Co-60	7.34E-02	1.82E-02	2.69E-05	2.65E-04	2.12E-10
SU30	FR0500	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU31	FR0500	2	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU32	FR0800	1	Co-60	7.79E-02	1.94E-02	2.69E-05	2.82E-04	2.25E-10
SU33	FR0810	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU34	FR0900	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU35	FR0900	2	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU36	FR0900	3	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU37	FR0900	4	Co-60	6.54E-02	1.63E-02	2.69E-05	2.37E-04	1.89E-10
SU38	FR0910	1	Co-60	7.72E-02	1.92E-02	2.69E-05	2.79E-04	2.23E-10
SU39	FR1000	0	Co-60	2.69E-01	6.69E-02	2.69E-05	9.73E-04	7.78E-10
SU40	FR1800	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU41	FR1800	2	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU42	FR1800	3	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU43	FR2900	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU44	FR2900	2	Co-60	4.20E-02	1.04E-02	2.69E-05	1.52E-04	1.22E-10
SU45	FR2900	3	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU46	FB1400	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU47	FB1500	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU48	FB1700	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU49	FB1900	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU50	FB2000	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU51	FB2600	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU52	FA0400	1	Co-60	1.33E-01	3.31E-02	2.69E-05	4.81E-04	3.85E-10

TABLE E-5

Estimation of Total Dose and Risk from Crop Ingestion from Radionuclides, Onsite Resident Exposure Scenario, (FGR-11 Dose to Risk Methodology)
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

$$Intake_{ci} = C_e \times [(IR_f \times B_f) + (IR_v \times B_v) + (IR_{lv} \times B_{lv})] \times 1000 \times CPF \times ED$$

$$Dose_{ci} = Intake_{si} \times DCF_i$$

$$ILCR = Dose_{ci} \times CF$$

Parameter	Units	Value	Description
I_{r_f}	kg/yr	7.7	Exposed aboveground produce ingestion rate
I_{r_v}	kg/yr	18.1	Protected & root produce ingestion rate
$I_{r_{lv}}$	kg/yr		Leafy vegetable ingestion rate
CPF	unitless	1	Contaminated plant fraction from site
ED	years	30	Exposure Duration
B_f	unitless	nuclide-specific	Soil-to-plant transfer coefficient, for fruit - converted to fresh weight basis
B_v	unitless	nuclide-specific	Soil-to-plant transfer coefficient, for protected/root vegetables - converted to fresh weight basis
B_{lv}	unitless	nuclide-specific	Soil-to-plant transfer coefficient, for leafy vegetables - converted to fresh-weight basis
CF	risk/mrem	8.00E-07	Dose to risk conversion factor

Radionuclide	Dose Conversion Factor (mrem/pCi)	Soil-to-plant transfer coefficient - fruit	Soil-to-plant transfer coefficient - root vegetables	Soil-to-plant transfer coefficient - leafy vegetables
Cs-137	5.00E-05	0.04	0.04	0.04
Co-60	2.69E-05	0.08	0.08	0.08

TABLE E-5

Estimation of Total Dose and Risk from Crop Ingestion from Radionuclides, Onsite Resident Exposure Scenario, (FGR-11 Dose to Risk Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Dose Conversion Factor (mrem/pCi)	Soil-to-plant transfer coefficient - fruit	Soil-to-plant transfer coefficient - root vegetables	Soil-to-plant transfer coefficient - leafy vegetables	Total Dose (mrem)	Increased Lifetime Cancer Risk
SU01	FR0100	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU02	FR0100	2	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU03	FR0100	3	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU04	FR0111	8	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU05	FR0111	9	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU06	FR0111	10	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU07	FR0111	11	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU08	FR0111	12	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU09	FR0111	13	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU10	FR0111	14	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU11	FR0111	15	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU12	FR0111	16	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU13	FR0111	17	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU14	FR0111	18	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU15	FR0111	19	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU16	FR0111	20	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU17	FR0200	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU18	FR0200	2	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU19	FR0200	3	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU20	FR0200	4	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU21	FR0200	5	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU22	FR0200	6	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU23	FR0200	7	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU24	FR0200	8	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU25	FR0200	9	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU26	FR0400	1	Cs-137	1.24E-01	8.96E-02	5.00E-05	4.00E-02	4.00E-02	4.00E-02	1.92E-01	1.53E-07
SU27	FR0400	2	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU30	FR0500	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU31	FR0500	2	Cs-137	2.26E-01	1.63E-01	5.00E-05	4.00E-02	4.00E-02	4.00E-02	3.49E-01	2.80E-07
SU32	FR0800	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU33	FR0810	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU34	FR0900	1	Cs-137	1.30E-02	9.39E-03	5.00E-05	4.00E-02	4.00E-02	4.00E-02	2.01E-02	1.61E-08
SU35	FR0900	2	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU36	FR0900	3	Cs-137	1.67E-01	1.21E-01	5.00E-05	4.00E-02	4.00E-02	4.00E-02	2.58E-01	2.07E-07
SU37	FR0900	4	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU38	FR0910	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU39	FR1000	0	Cs-137	1.62E-01	1.17E-01	5.00E-05	4.00E-02	4.00E-02	4.00E-02	2.51E-01	2.00E-07
SU40	FR1800	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU41	FR1800	2	Cs-137	4.10E-02	2.96E-02	5.00E-05	4.00E-02	4.00E-02	4.00E-02	6.34E-02	5.07E-08
SU42	FR1800	3	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU43	FR2900	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00

TABLE E-5

Estimation of Total Dose and Risk from Crop Ingestion from Radionuclides, Onsite Resident Exposure Scenario, (FGR-11 Dose to Risk Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Dose Conversion Factor (mrem/pCi)	Soil-to-plant transfer coefficient - fruit	Soil-to-plant transfer coefficient - root vegetables	Soil-to-plant transfer coefficient - leafy vegetables	Total Dose (mrem)	Increased Lifetime Cancer Risk
SU44	FR2900	2	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU45	FR2900	3	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU46	FB1400	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU47	FB1500	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU48	FB1700	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU49	FB1900	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU50	FB2000	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU51	FB2600	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU52	FA0400	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	4.00E-02	4.00E-02	4.00E-02	0.00E+00	0.00E+00
SU01	FR0100	1	Co-60	0.00E+00	0.00E+00	2.69E-05	8.00E-02	8.00E-02	8.00E-02	0.00E+00	0.00E+00
SU02	FR0100	2	Co-60	5.08E-02	1.26E-02	2.69E-05	8.00E-02	8.00E-02	8.00E-02	8.47E-02	6.78E-08
SU03	FR0100	3	Co-60	0.00E+00	0.00E+00	2.69E-05	8.00E-02	8.00E-02	8.00E-02	0.00E+00	0.00E+00
SU04	FR0111	8	Co-60	0.00E+00	0.00E+00	2.69E-05	8.00E-02	8.00E-02	8.00E-02	0.00E+00	0.00E+00
SU05	FR0111	9	Co-60	5.78E-02	1.44E-02	2.69E-05	8.00E-02	8.00E-02	8.00E-02	9.64E-02	7.71E-08
SU06	FR0111	10	Co-60	7.18E-02	1.79E-02	2.69E-05	8.00E-02	8.00E-02	8.00E-02	1.20E-01	9.58E-08
SU07	FR0111	11	Co-60	6.54E-02	1.63E-02	2.69E-05	8.00E-02	8.00E-02	8.00E-02	1.09E-01	8.73E-08
SU08	FR0111	12	Co-60	6.05E-02	1.50E-02	2.69E-05	8.00E-02	8.00E-02	8.00E-02	1.01E-01	8.07E-08
SU09	FR0111	13	Co-60	0.00E+00	0.00E+00	2.69E-05	8.00E-02	8.00E-02	8.00E-02	0.00E+00	0.00E+00
SU10	FR0111	14	Co-60	5.23E-02	1.30E-02	2.69E-05	8.00E-02	8.00E-02	8.00E-02	8.72E-02	6.98E-08
SU11	FR0111	15	Co-60	5.99E-02	1.49E-02	2.69E-05	8.00E-02	8.00E-02	8.00E-02	9.99E-02	7.99E-08
SU12	FR0111	16	Co-60	7.92E-02	1.97E-02	2.69E-05	8.00E-02	8.00E-02	8.00E-02	1.32E-01	1.06E-07
SU13	FR0111	17	Co-60	5.48E-02	1.36E-02	2.69E-05	8.00E-02	8.00E-02	8.00E-02	9.14E-02	7.31E-08
SU14	FR0111	18	Co-60	0.00E+00	0.00E+00	2.69E-05	8.00E-02	8.00E-02	8.00E-02	0.00E+00	0.00E+00
SU15	FR0111	19	Co-60	0.00E+00	0.00E+00	2.69E-05	8.00E-02	8.00E-02	8.00E-02	0.00E+00	0.00E+00
SU16	FR0111	20	Co-60	8.66E-02	2.15E-02	2.69E-05	8.00E-02	8.00E-02	8.00E-02	1.44E-01	1.16E-07
SU17	FR0200	1	Co-60	0.00E+00	0.00E+00	2.69E-05	8.00E-02	8.00E-02	8.00E-02	0.00E+00	0.00E+00
SU18	FR0200	2	Co-60	0.00E+00	0.00E+00	2.69E-05	8.00E-02	8.00E-02	8.00E-02	0.00E+00	0.00E+00
SU19	FR0200	3	Co-60	0.00E+00	0.00E+00	2.69E-05	8.00E-02	8.00E-02	8.00E-02	0.00E+00	0.00E+00
SU20	FR0200	4	Co-60	5.43E-02	1.35E-02	2.69E-05	8.00E-02	8.00E-02	8.00E-02	9.06E-02	7.25E-08
SU21	FR0200	5	Co-60	6.39E-02	1.59E-02	2.69E-05	8.00E-02	8.00E-02	8.00E-02	1.07E-01	8.53E-08
SU22	FR0200	6	Co-60	5.93E-02	1.47E-02	2.69E-05	8.00E-02	8.00E-02	8.00E-02	9.89E-02	7.91E-08
SU23	FR0200	7	Co-60	6.76E-02	1.68E-02	2.69E-05	8.00E-02	8.00E-02	8.00E-02	1.13E-01	9.02E-08
SU24	FR0200	8	Co-60	5.49E-02	1.36E-02	2.69E-05	8.00E-02	8.00E-02	8.00E-02	9.16E-02	7.33E-08
SU25	FR0200	9	Co-60	7.76E-02	1.93E-02	2.69E-05	8.00E-02	8.00E-02	8.00E-02	1.29E-01	1.04E-07
SU26	FR0400	1	Co-60	5.45E-01	1.36E-01	2.69E-05	8.00E-02	8.00E-02	8.00E-02	9.09E-01	7.27E-07
SU27	FR0400	2	Co-60	7.34E-02	1.82E-02	2.69E-05	8.00E-02	8.00E-02	8.00E-02	1.22E-01	9.79E-08
SU30	FR0500	1	Co-60	0.00E+00	0.00E+00	2.69E-05	8.00E-02	8.00E-02	8.00E-02	0.00E+00	0.00E+00
SU31	FR0500	2	Co-60	0.00E+00	0.00E+00	2.69E-05	8.00E-02	8.00E-02	8.00E-02	0.00E+00	0.00E+00
SU32	FR0800	1	Co-60	7.79E-02	1.94E-02	2.69E-05	8.00E-02	8.00E-02	8.00E-02	1.30E-01	1.04E-07
SU33	FR0810	1	Co-60	0.00E+00	0.00E+00	2.69E-05	8.00E-02	8.00E-02	8.00E-02	0.00E+00	0.00E+00

TABLE E-5

Estimation of Total Dose and Risk from Crop Ingestion from Radionuclides, Onsite Resident Exposure Scenario, (FGR-11 Dose to Risk Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Dose Conversion Factor (mrem/pCi)	Soil-to-plant transfer coefficient - fruit	Soil-to-plant transfer coefficient - root vegetables	Soil-to-plant transfer coefficient - leafy vegetables	Total Dose (mrem)	Increased Lifetime Cancer Risk
SU34	FR0900	1	Co-60	0.00E+00	0.00E+00	2.69E-05	8.00E-02	8.00E-02	8.00E-02	0.00E+00	0.00E+00
SU35	FR0900	2	Co-60	0.00E+00	0.00E+00	2.69E-05	8.00E-02	8.00E-02	8.00E-02	0.00E+00	0.00E+00
SU36	FR0900	3	Co-60	0.00E+00	0.00E+00	2.69E-05	8.00E-02	8.00E-02	8.00E-02	0.00E+00	0.00E+00
SU37	FR0900	4	Co-60	6.54E-02	1.63E-02	2.69E-05	8.00E-02	8.00E-02	8.00E-02	1.09E-01	8.73E-08
SU38	FR0910	1	Co-60	7.72E-02	1.92E-02	2.69E-05	8.00E-02	8.00E-02	8.00E-02	1.29E-01	1.03E-07
SU39	FR1000	0	Co-60	2.69E-01	6.69E-02	2.69E-05	8.00E-02	8.00E-02	8.00E-02	4.49E-01	3.59E-07
SU40	FR1800	1	Co-60	0.00E+00	0.00E+00	2.69E-05	8.00E-02	8.00E-02	8.00E-02	0.00E+00	0.00E+00
SU41	FR1800	2	Co-60	0.00E+00	0.00E+00	2.69E-05	8.00E-02	8.00E-02	8.00E-02	0.00E+00	0.00E+00
SU42	FR1800	3	Co-60	0.00E+00	0.00E+00	2.69E-05	8.00E-02	8.00E-02	8.00E-02	0.00E+00	0.00E+00
SU43	FR2900	1	Co-60	0.00E+00	0.00E+00	2.69E-05	8.00E-02	8.00E-02	8.00E-02	0.00E+00	0.00E+00
SU44	FR2900	2	Co-60	4.20E-02	1.04E-02	2.69E-05	8.00E-02	8.00E-02	8.00E-02	7.01E-02	5.60E-08
SU45	FR2900	3	Co-60	0.00E+00	0.00E+00	2.69E-05	8.00E-02	8.00E-02	8.00E-02	0.00E+00	0.00E+00
SU46	FB1400	1	Co-60	0.00E+00	0.00E+00	2.69E-05	8.00E-02	8.00E-02	8.00E-02	0.00E+00	0.00E+00
SU47	FB1500	1	Co-60	0.00E+00	0.00E+00	2.69E-05	8.00E-02	8.00E-02	8.00E-02	0.00E+00	0.00E+00
SU48	FB1700	1	Co-60	0.00E+00	0.00E+00	2.69E-05	8.00E-02	8.00E-02	8.00E-02	0.00E+00	0.00E+00
SU49	FB1900	1	Co-60	0.00E+00	0.00E+00	2.69E-05	8.00E-02	8.00E-02	8.00E-02	0.00E+00	0.00E+00
SU50	FB2000	1	Co-60	0.00E+00	0.00E+00	2.69E-05	8.00E-02	8.00E-02	8.00E-02	0.00E+00	0.00E+00
SU51	FB2600	1	Co-60	0.00E+00	0.00E+00	2.69E-05	8.00E-02	8.00E-02	8.00E-02	0.00E+00	0.00E+00
SU52	FA0400	1	Co-60	1.33E-01	3.31E-02	2.69E-05	8.00E-02	8.00E-02	8.00E-02	2.22E-01	1.77E-07

TABLE E-6

Estimation of Total Dose and Risk from External Exposure from Radionuclides, Onsite Resident Exposure Scenario, (FGR12 Dose-to-Risk Methodology)
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

$$E = C \times \left(\frac{EF}{365} \right) \times ED \times BD \times 1E+06 \times 3.15E+07 \times ACF \times [ET_o + (ET_i \times GSF)]$$

$$Dose_e = E \times DCF$$

$$ILCR = Dose_e \times CF$$

Parameter	Units	Value	Description
E	pCi - s/m ³	Calculated	Exposure rate from soil
C	pCi/g	Input	Concentration in soil, averaged over exposure duration
EF	days/year	350	Exposure frequency
ED	years	30	Exposure duration
BD	g/cm ³	1.60	Bulk density of soil
ACF	unitless	0.90	Area correction factor
ET _o	unitless	0.073	Exposure time outdoors
ET _i	unitless	0.683	Exposure time indoors
GSF	unitless	0.40	Indoor gamma shielding factor
DCF _i	mrem/pCi	Nuclide-specific	Dose conversion factor for ingestion (from FGR 11)
ILCR	unitless	Calculated	Increased lifetime cancer risk
CF	risk/mrem	8.00E-07	Dose to risk conversion factor
1.00E+06	cm ³ /m ³		Conversion factor
3.15E+07	s/year		Conversion factor

Radionuclide	Dose Conversion Factor (mrem/pCi)
Cs-137	7.14E-14
Co-60	3.21E-13

TABLE E-6

Estimation of Total Dose and Risk from External Exposure from Radionuclides, Onsite Resident Exposure Scenario, (FGR12 Dose-to-Risk Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Exposure Rate from Soil (pCi - s/m ³)	Dose Conversion Factor (mrem/pCi)	Total Dose (mrem)	Increased Lifetime Cancer Risk
SU01	FR0100	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU02	FR0100	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU03	FR0100	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU04	FR0111	8	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU05	FR0111	9	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU06	FR0111	10	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU07	FR0111	11	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU08	FR0111	12	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU09	FR0111	13	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU10	FR0111	14	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU11	FR0111	15	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU12	FR0111	16	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU13	FR0111	17	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU14	FR0111	18	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU15	FR0111	19	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU16	FR0111	20	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU17	FR0200	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU18	FR0200	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU19	FR0200	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU20	FR0200	4	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU21	FR0200	5	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU22	FR0200	6	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU23	FR0200	7	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU24	FR0200	8	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU25	FR0200	9	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU26	FR0400	1	Cs-137	1.24E-01	8.96E-02	4.05E+13	7.14E-14	2.89E+00	2.31E-06
SU27	FR0400	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU30	FR0500	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU31	FR0500	2	Cs-137	2.26E-01	1.63E-01	7.38E+13	7.14E-14	5.27E+00	4.21E-06
SU32	FR0800	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU33	FR0810	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU34	FR0900	1	Cs-137	1.30E-02	9.39E-03	4.24E+12	7.14E-14	3.03E-01	2.42E-07
SU35	FR0900	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU36	FR0900	3	Cs-137	1.67E-01	1.21E-01	5.45E+13	7.14E-14	3.89E+00	3.11E-06
SU37	FR0900	4	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU38	FR0910	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU39	FR1000	0	Cs-137	1.62E-01	1.17E-01	5.29E+13	7.14E-14	3.78E+00	3.02E-06
SU40	FR1800	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU41	FR1800	2	Cs-137	4.10E-02	2.96E-02	1.34E+13	7.14E-14	9.56E-01	7.65E-07
SU42	FR1800	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU43	FR2900	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU44	FR2900	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU45	FR2900	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU46	FB1400	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU47	FB1500	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU48	FB1700	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU49	FB1900	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU50	FB2000	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU51	FB2600	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU52	FA0400	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00

TABLE E-6

Estimation of Total Dose and Risk from External Exposure from Radionuclides, Onsite Resident Exposure Scenario, (FGR12 Dose-to-Risk Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Exposure Rate from Soil (pCi - s/m ³)	Dose Conversion Factor (mrem/pCi)	Total Dose (mrem)	Increased Lifetime Cancer Risk
SU01	FR0100	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU02	FR0100	2	Co-60	5.08E-02	1.26E-02	5.71E+12	3.21E-13	1.83E+00	1.47E-06
SU03	FR0100	3	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU04	FR0111	8	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU05	FR0111	9	Co-60	5.78E-02	1.44E-02	6.49E+12	3.21E-13	2.08E+00	1.67E-06
SU06	FR0111	10	Co-60	7.18E-02	1.79E-02	8.06E+12	3.21E-13	2.59E+00	2.07E-06
SU07	FR0111	11	Co-60	6.54E-02	1.63E-02	7.35E+12	3.21E-13	2.36E+00	1.89E-06
SU08	FR0111	12	Co-60	6.05E-02	1.50E-02	6.80E+12	3.21E-13	2.18E+00	1.75E-06
SU09	FR0111	13	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU10	FR0111	14	Co-60	5.23E-02	1.30E-02	5.87E+12	3.21E-13	1.89E+00	1.51E-06
SU11	FR0111	15	Co-60	5.99E-02	1.49E-02	6.73E+12	3.21E-13	2.16E+00	1.73E-06
SU12	FR0111	16	Co-60	7.92E-02	1.97E-02	8.90E+12	3.21E-13	2.86E+00	2.29E-06
SU13	FR0111	17	Co-60	5.48E-02	1.36E-02	6.15E+12	3.21E-13	1.98E+00	1.58E-06
SU14	FR0111	18	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU15	FR0111	19	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU16	FR0111	20	Co-60	8.66E-02	2.15E-02	9.73E+12	3.21E-13	3.12E+00	2.50E-06
SU17	FR0200	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU18	FR0200	2	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU19	FR0200	3	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU20	FR0200	4	Co-60	5.43E-02	1.35E-02	6.10E+12	3.21E-13	1.96E+00	1.57E-06
SU21	FR0200	5	Co-60	6.39E-02	1.59E-02	7.18E+12	3.21E-13	2.30E+00	1.84E-06
SU22	FR0200	6	Co-60	5.93E-02	1.47E-02	6.66E+12	3.21E-13	2.14E+00	1.71E-06
SU23	FR0200	7	Co-60	6.76E-02	1.68E-02	7.59E+12	3.21E-13	2.44E+00	1.95E-06
SU24	FR0200	8	Co-60	5.49E-02	1.36E-02	6.17E+12	3.21E-13	1.98E+00	1.58E-06
SU25	FR0200	9	Co-60	7.76E-02	1.93E-02	8.72E+12	3.21E-13	2.80E+00	2.24E-06
SU26	FR0400	1	Co-60	5.45E-01	1.36E-01	6.12E+13	3.21E-13	1.97E+01	1.57E-05
SU27	FR0400	2	Co-60	7.34E-02	1.82E-02	8.24E+12	3.21E-13	2.65E+00	2.12E-06
SU30	FR0500	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU31	FR0500	2	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU32	FR0800	1	Co-60	7.79E-02	1.94E-02	8.75E+12	3.21E-13	2.81E+00	2.25E-06
SU33	FR0810	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU34	FR0900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU35	FR0900	2	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU36	FR0900	3	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU37	FR0900	4	Co-60	6.54E-02	1.63E-02	7.35E+12	3.21E-13	2.36E+00	1.89E-06
SU38	FR0910	1	Co-60	7.72E-02	1.92E-02	8.67E+12	3.21E-13	2.78E+00	2.23E-06
SU39	FR1000	0	Co-60	2.69E-01	6.69E-02	3.02E+13	3.21E-13	9.70E+00	7.76E-06
SU40	FR1800	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU41	FR1800	2	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU42	FR1800	3	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU43	FR2900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU44	FR2900	2	Co-60	4.20E-02	1.04E-02	4.72E+12	3.21E-13	1.52E+00	1.21E-06
SU45	FR2900	3	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU46	FB1400	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU47	FB1500	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU48	FB1700	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU49	FB1900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU50	FB2000	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU51	FB2600	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU52	FA0400	1	Co-60	1.33E-01	3.31E-02	1.49E+13	3.21E-13	4.80E+00	3.84E-06

TABLE E-7

Estimation of Total Dose and Risk from Radionuclides, Onsite Worker Exposure Scenario, (FGR11 Dose-to-Risk Methodology

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Total Dose Over Exposure Duration (mrem)			Excess Lifetime Cancer Risk			Total Radionuclide Excess Lifetime Cancer Risk
						Soil Ingestion	External Exposure	Total	Soil Ingestion	External Exposure	Total	
SU01	FR0100	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU02	FR0100	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.17E-07
SU03	FR0100	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU04	FR0111	8	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU05	FR0111	9	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.74E-07
SU06	FR0111	10	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.89E-07
SU07	FR0111	11	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.36E-07
SU08	FR0111	12	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.96E-07
SU09	FR0111	13	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU10	FR0111	14	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.29E-07
SU11	FR0111	15	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.91E-07
SU12	FR0111	16	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.50E-07
SU13	FR0111	17	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.49E-07
SU14	FR0111	18	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU15	FR0111	19	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU16	FR0111	20	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.10E-07
SU17	FR0200	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU18	FR0200	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU19	FR0200	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU20	FR0200	4	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.45E-07
SU21	FR0200	5	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.24E-07
SU22	FR0200	6	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.86E-07
SU23	FR0200	7	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.54E-07
SU24	FR0200	8	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.50E-07
SU25	FR0200	9	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.36E-07
SU26	FR0400	1	Cs-137	1.24E-01	9.43E-02	1.77E-03	7.34E-01	7.36E-01	1.41E-09	5.87E-07	5.89E-07	5.06E-06
SU27	FR0400	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.02E-07
SU30	FR0500	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU31	FR0500	2	Cs-137	2.26E-01	1.72E-01	3.22E-03	1.34E+00	1.34E+00	2.58E-09	1.07E-06	1.07E-06	1.07E-06
SU32	FR0800	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.39E-07
SU33	FR0810	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU34	FR0900	1	Cs-137	1.30E-02	9.89E-03	1.85E-04	7.70E-02	7.71E-02	1.48E-10	6.16E-08	6.17E-08	6.17E-08
SU35	FR0900	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU36	FR0900	3	Cs-137	1.67E-01	1.27E-01	2.38E-03	9.89E-01	9.91E-01	1.90E-09	7.91E-07	7.93E-07	7.93E-07
SU37	FR0900	4	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.36E-07
SU38	FR0910	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.33E-07
SU39	FR1000	0	Cs-137	1.62E-01	1.23E-01	2.31E-03	9.59E-01	9.61E-01	1.85E-09	7.67E-07	7.69E-07	2.98E-06
SU40	FR1800	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU41	FR1800	2	Cs-137	4.10E-02	3.12E-02	5.84E-04	2.43E-01	2.43E-01	4.67E-10	1.94E-07	1.95E-07	1.95E-07
SU42	FR1800	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU43	FR2900	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU44	FR2900	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.44E-07
SU45	FR2900	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU46	FB1400	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU47	FB1500	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU48	FB1700	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU49	FB1900	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE E-7

Estimation of Total Dose and Risk from Radionuclides, Onsite Worker Exposure Scenario, (FGR11 Dose-to-Risk Methodology
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Total Dose Over Exposure Duration (mrem)			Excess Lifetime Cancer Risk			Total Radionuclide Excess Lifetime Cancer Risk
						Soil Ingestion	External Exposure	Total	Soil Ingestion	External Exposure	Total	
SU50	FB2000	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU51	FB2600	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU52	FA0400	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
												5.06E-06
SU01	FR0100	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU02	FR0100	2	Co-60	5.08E-02	1.49E-02	1.50E-04	5.21E-01	5.21E-01	1.20E-10	4.16E-07	4.17E-07	
SU03	FR0100	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU04	FR0111	8	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU05	FR0111	9	Co-60	5.78E-02	1.69E-02	1.71E-04	5.92E-01	5.93E-01	1.37E-10	4.74E-07	4.74E-07	
SU06	FR0111	10	Co-60	7.18E-02	2.10E-02	2.12E-04	7.36E-01	7.36E-01	1.70E-10	5.89E-07	5.89E-07	
SU07	FR0111	11	Co-60	6.54E-02	1.92E-02	1.93E-04	6.70E-01	6.70E-01	1.55E-10	5.36E-07	5.36E-07	
SU08	FR0111	12	Co-60	6.05E-02	1.77E-02	1.79E-04	6.20E-01	6.20E-01	1.43E-10	4.96E-07	4.96E-07	
SU09	FR0111	13	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU10	FR0111	14	Co-60	5.23E-02	1.53E-02	1.55E-04	5.36E-01	5.36E-01	1.24E-10	4.29E-07	4.29E-07	
SU11	FR0111	15	Co-60	5.99E-02	1.75E-02	1.77E-04	6.14E-01	6.14E-01	1.42E-10	4.91E-07	4.91E-07	
SU12	FR0111	16	Co-60	7.92E-02	2.32E-02	2.34E-04	8.12E-01	8.12E-01	1.87E-10	6.49E-07	6.50E-07	
SU13	FR0111	17	Co-60	5.48E-02	1.60E-02	1.62E-04	5.62E-01	5.62E-01	1.30E-10	4.49E-07	4.49E-07	
SU14	FR0111	18	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU15	FR0111	19	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU16	FR0111	20	Co-60	8.66E-02	2.54E-02	2.56E-04	8.88E-01	8.88E-01	2.05E-10	7.10E-07	7.10E-07	
SU17	FR0200	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU18	FR0200	2	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU19	FR0200	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU20	FR0200	4	Co-60	5.43E-02	1.59E-02	1.61E-04	5.56E-01	5.57E-01	1.29E-10	4.45E-07	4.45E-07	
SU21	FR0200	5	Co-60	6.39E-02	1.87E-02	1.89E-04	6.55E-01	6.55E-01	1.51E-10	5.24E-07	5.24E-07	
SU22	FR0200	6	Co-60	5.93E-02	1.74E-02	1.75E-04	6.08E-01	6.08E-01	1.40E-10	4.86E-07	4.86E-07	
SU23	FR0200	7	Co-60	6.76E-02	1.98E-02	2.00E-04	6.93E-01	6.93E-01	1.60E-10	5.54E-07	5.54E-07	
SU24	FR0200	8	Co-60	5.49E-02	1.61E-02	1.62E-04	5.63E-01	5.63E-01	1.30E-10	4.50E-07	4.50E-07	
SU25	FR0200	9	Co-60	7.76E-02	2.27E-02	2.30E-04	7.95E-01	7.96E-01	1.84E-10	6.36E-07	6.36E-07	
SU26	FR0400	1	Co-60	5.45E-01	1.60E-01	1.61E-03	5.59E+00	5.59E+00	1.29E-09	4.47E-06	4.47E-06	
SU27	FR0400	2	Co-60	7.34E-02	2.15E-02	2.17E-04	7.52E-01	7.52E-01	1.74E-10	6.02E-07	6.02E-07	
SU30	FR0500	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU31	FR0500	2	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU32	FR0800	1	Co-60	7.79E-02	2.28E-02	2.30E-04	7.98E-01	7.99E-01	1.84E-10	6.39E-07	6.39E-07	
SU33	FR0810	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU34	FR0900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU35	FR0900	2	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU36	FR0900	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU37	FR0900	4	Co-60	6.54E-02	1.92E-02	1.93E-04	6.70E-01	6.70E-01	1.55E-10	5.36E-07	5.36E-07	
SU38	FR0910	1	Co-60	7.72E-02	2.26E-02	2.28E-04	7.91E-01	7.91E-01	1.83E-10	6.33E-07	6.33E-07	
SU39	FR1000	0	Co-60	2.69E-01	7.88E-02	7.96E-04	2.76E+00	2.76E+00	6.37E-10	2.21E-06	2.21E-06	
SU40	FR1800	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU41	FR1800	2	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU42	FR1800	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU43	FR2900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU44	FR2900	2	Co-60	4.20E-02	1.23E-02	1.24E-04	4.30E-01	4.31E-01	9.94E-11	3.44E-07	3.44E-07	
SU45	FR2900	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	

TABLE E-7
 Estimation of Total Dose and Risk from Radionuclides, Onsite Worker Exposure Scenario, (FGR11 Dose-to-Risk Methodology)
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Total Dose Over Exposure Duration (mrem)			Excess Lifetime Cancer Risk			Total Radionuclide Excess Lifetime Cancer Risk
						Soil Ingestion	External Exposure	Total	Soil Ingestion	External Exposure	Total	
SU46	FB1400	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU47	FB1500	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU48	FB1700	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU49	FB1900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU50	FB2000	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU51	FB2600	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU52	FA0400	1	Co-60	1.33E-01	3.90E-02	3.93E-04	1.36E+00	1.36E+00	3.15E-10	1.09E-06	1.09E-06	

TABLE E-8

Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Onsite Worker Exposure Scenario, (FGR11 Dose-to-Risk Methodology)
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

$$Intake_{si} = C_e \times IR_{si} \times 0.001 \times EF \times ED$$

$$Dose_{si} = Intake_{si} \times DCF_i$$

$$ILCR = Dose_{si} \times CF$$

Parameter	Units	Value	Description
Intake _{si}	pCi	Calculated	Radionuclide exposure through soil ingestion
C _e	pCi/g	Nuclide-specific	Exposure concentration in soil
IR _{si}	mg/day	100	Soil ingestion rate (0.001 g/mg is a conversion factor)
EF	days/year	150	Exposure frequency
ED	years	25	Exposure duration
DCF _i	mrem/pCi	Nuclide-specific	Dose conversion factor for ingestion (from FGR 11)
ILCR	unitless	Calculated	Increased lifetime cancer risk
CF	risk/mrem	8.00E-07	Dose to risk conversion factor

Radionuclide	Dose Conversion Factor (mrem/pCi)
Cs-137	5.00E-05
Co-60	2.69E-05

TABLE E-8

Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Onsite Worker Exposure Scenario, (FGR11 Dose-to-Risk Methodology

*Cumulative Risk Assessment**Maine Yankee Facility, Wiscasset, ME*

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Dose Conversion Factor (mrem/pCi)	Total Dose (mrem)	Increased Lifetime Cancer Risk
SU01	FR0100	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU02	FR0100	2	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU03	FR0100	3	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU04	FR0111	8	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU05	FR0111	9	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU06	FR0111	10	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU07	FR0111	11	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU08	FR0111	12	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU09	FR0111	13	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU10	FR0111	14	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU11	FR0111	15	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU12	FR0111	16	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU13	FR0111	17	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU14	FR0111	18	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU15	FR0111	19	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU16	FR0111	20	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU17	FR0200	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU18	FR0200	2	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU19	FR0200	3	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU20	FR0200	4	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU21	FR0200	5	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU22	FR0200	6	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU23	FR0200	7	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU24	FR0200	8	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU25	FR0200	9	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU26	FR0400	1	Cs-137	1.24E-01	9.43E-02	5.00E-05	1.77E-03	1.41E-09
SU27	FR0400	2	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU30	FR0500	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU31	FR0500	2	Cs-137	2.26E-01	1.72E-01	5.00E-05	3.22E-03	2.58E-09
SU32	FR0800	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU33	FR0810	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU34	FR0900	1	Cs-137	1.30E-02	9.89E-03	5.00E-05	1.85E-04	1.48E-10
SU35	FR0900	2	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU36	FR0900	3	Cs-137	1.67E-01	1.27E-01	5.00E-05	2.38E-03	1.90E-09
SU37	FR0900	4	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU38	FR0910	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU39	FR1000	0	Cs-137	1.62E-01	1.23E-01	5.00E-05	2.31E-03	1.85E-09
SU40	FR1800	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00

TABLE E-8

Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Onsite Worker Exposure Scenario, (FGR11 Dose-to-Risk Methodology
Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Dose Conversion Factor (mrem/pCi)	Total Dose (mrem)	Increased Lifetime Cancer Risk
SU41	FR1800	2	Cs-137	4.10E-02	3.12E-02	5.00E-05	5.84E-04	4.67E-10
SU42	FR1800	3	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU43	FR2900	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU44	FR2900	2	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU45	FR2900	3	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU46	FB1400	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU47	FB1500	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU48	FB1700	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU49	FB1900	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU50	FB2000	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU51	FB2600	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU52	FA0400	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU01	FR0100	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU02	FR0100	2	Co-60	5.08E-02	1.49E-02	2.69E-05	1.50E-04	1.20E-10
SU03	FR0100	3	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU04	FR0111	8	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU05	FR0111	9	Co-60	5.78E-02	1.69E-02	2.69E-05	1.71E-04	1.37E-10
SU06	FR0111	10	Co-60	7.18E-02	2.10E-02	2.69E-05	2.12E-04	1.70E-10
SU07	FR0111	11	Co-60	6.54E-02	1.92E-02	2.69E-05	1.93E-04	1.55E-10
SU08	FR0111	12	Co-60	6.05E-02	1.77E-02	2.69E-05	1.79E-04	1.43E-10
SU09	FR0111	13	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU10	FR0111	14	Co-60	5.23E-02	1.53E-02	2.69E-05	1.55E-04	1.24E-10
SU11	FR0111	15	Co-60	5.99E-02	1.75E-02	2.69E-05	1.77E-04	1.42E-10
SU12	FR0111	16	Co-60	7.92E-02	2.32E-02	2.69E-05	2.34E-04	1.87E-10
SU13	FR0111	17	Co-60	5.48E-02	1.60E-02	2.69E-05	1.62E-04	1.30E-10
SU14	FR0111	18	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU15	FR0111	19	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU16	FR0111	20	Co-60	8.66E-02	2.54E-02	2.69E-05	2.56E-04	2.05E-10
SU17	FR0200	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU18	FR0200	2	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU19	FR0200	3	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU20	FR0200	4	Co-60	5.43E-02	1.59E-02	2.69E-05	1.61E-04	1.29E-10
SU21	FR0200	5	Co-60	6.39E-02	1.87E-02	2.69E-05	1.89E-04	1.51E-10
SU22	FR0200	6	Co-60	5.93E-02	1.74E-02	2.69E-05	1.75E-04	1.40E-10
SU23	FR0200	7	Co-60	6.76E-02	1.98E-02	2.69E-05	2.00E-04	1.60E-10
SU24	FR0200	8	Co-60	5.49E-02	1.61E-02	2.69E-05	1.62E-04	1.30E-10
SU25	FR0200	9	Co-60	7.76E-02	2.27E-02	2.69E-05	2.30E-04	1.84E-10

TABLE E-8

Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Onsite Worker Exposure Scenario, (FGR11 Dose-to-Risk Methodology
Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Dose Conversion Factor (mrem/pCi)	Total Dose (mrem)	Increased Lifetime Cancer Risk
SU26	FR0400	1	Co-60	5.45E-01	1.60E-01	2.69E-05	1.61E-03	1.29E-09
SU27	FR0400	2	Co-60	7.34E-02	2.15E-02	2.69E-05	2.17E-04	1.74E-10
SU30	FR0500	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU31	FR0500	2	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU32	FR0800	1	Co-60	7.79E-02	2.28E-02	2.69E-05	2.30E-04	1.84E-10
SU33	FR0810	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU34	FR0900	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU35	FR0900	2	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU36	FR0900	3	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU37	FR0900	4	Co-60	6.54E-02	1.92E-02	2.69E-05	1.93E-04	1.55E-10
SU38	FR0910	1	Co-60	7.72E-02	2.26E-02	2.69E-05	2.28E-04	1.83E-10
SU39	FR1000	0	Co-60	2.69E-01	7.88E-02	2.69E-05	7.96E-04	6.37E-10
SU40	FR1800	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU41	FR1800	2	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU42	FR1800	3	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU43	FR2900	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU44	FR2900	2	Co-60	4.20E-02	1.23E-02	2.69E-05	1.24E-04	9.94E-11
SU45	FR2900	3	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU46	FB1400	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU47	FB1500	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU48	FB1700	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU49	FB1900	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU50	FB2000	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU51	FB2600	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU52	FA0400	1	Co-60	1.33E-01	3.90E-02	2.69E-05	3.93E-04	3.15E-10

TABLE E-9

Estimation of Total Dose and Risk from External Exposure from Radionuclides, Onsite Worker Exposure Scenario, (FGR12 Dose-to-Risk Methodology)
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

$$E = C \times \left(\frac{EF}{365} \right) \times ED \times BD \times 1E+06 \times 3.15E+07 \times ACF \times [ET_o + (ET_i \times GSF)]$$

$$Dose_e = E \times DCF$$

$$ILCR = Dose_e \times CF$$

Parameter	Units	Value	Description
E	pCi - s/m ³	Calculated	Exposure rate from soil
C	pCi/g	Input	Concentration in soil, averaged over exposure duration
EF	days/year	150	Exposure frequency
ED	years	25	Exposure duration
BD	g/cm ³	1.60	Bulk density of soil
ACF	unitless	0.90	Area correction factor
ET _o	unitless	0.167	Exposure time outdoors
ET _i	unitless	0.167	Exposure time indoors
GSF	unitless	0.40	Indoor gamma shielding factor
DCF _i	mrem/pCi	Nuclide-specific	Dose conversion factor for ingestion (from FGR 11)
ILCR	unitless	Calculated	Increased lifetime cancer risk
CF	risk/mrem	8.00E-07	Dose to risk conversion factor
1.00E+06	cm ³ /m ³		Conversion factor
3.15E+07	s/year		Conversion factor

Notes:

ET_o value assumes an 8 hour work day, where half of the time is spent outdoors. (8/24)0.5=0.167

ET_i value assumes an 8 hour work day, where half of the time is spent indoors. (8/24)0.5=0.167

Radionuclide	Dose Conversion Factor (mrem/pCi)
Cs-137	7.141E-14
Co-60	3.2116E-13

TABLE E-9

Estimation of Total Dose and Risk from External Exposure from Radionuclides, Onsite Worker Exposure Scenario, (FGR12 Dose-to-Risk Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Exposure Rate from Soil (pCi - s/m3)	Dose Conversion Factor (mrem/pCi)	Total Dose (mrem)	Increased Lifetime Cancer Risk
SU01	FR0100	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU02	FR0100	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU03	FR0100	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU04	FR0111	8	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU05	FR0111	9	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU06	FR0111	10	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU07	FR0111	11	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU08	FR0111	12	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU09	FR0111	13	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU10	FR0111	14	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU11	FR0111	15	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU12	FR0111	16	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU13	FR0111	17	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU14	FR0111	18	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU15	FR0111	19	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU16	FR0111	20	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU17	FR0200	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU18	FR0200	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU19	FR0200	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU20	FR0200	4	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU21	FR0200	5	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU22	FR0200	6	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU23	FR0200	7	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU24	FR0200	8	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU25	FR0200	9	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU26	FR0400	1	Cs-137	1.24E-01	9.43E-02	1.03E+13	7.141E-14	7.34E-01	5.87E-07
SU27	FR0400	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU30	FR0500	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU31	FR0500	2	Cs-137	2.26E-01	1.72E-01	1.87E+13	7.141E-14	1.34E+00	1.07E-06
SU32	FR0800	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU33	FR0810	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU34	FR0900	1	Cs-137	1.30E-02	9.89E-03	1.08E+12	7.141E-14	7.70E-02	6.16E-08
SU35	FR0900	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU36	FR0900	3	Cs-137	1.67E-01	1.27E-01	1.38E+13	7.141E-14	9.89E-01	7.91E-07
SU37	FR0900	4	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU38	FR0910	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU39	FR1000	0	Cs-137	1.62E-01	1.23E-01	1.34E+13	7.141E-14	9.59E-01	7.67E-07
SU40	FR1800	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU41	FR1800	2	Cs-137	4.10E-02	3.12E-02	3.40E+12	7.141E-14	2.43E-01	1.94E-07
SU42	FR1800	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU43	FR2900	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00

TABLE E-9

Estimation of Total Dose and Risk from External Exposure from Radionuclides, Onsite Worker Exposure Scenario, (FGR12 Dose-to-Risk Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Exposure Rate from Soil (pCi - s/m3)	Dose Conversion Factor (mrem/pCi)	Total Dose (mrem)	Increased Lifetime Cancer Risk
SU44	FR2900	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU45	FR2900	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU46	FB1400	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU47	FB1500	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU48	FB1700	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU49	FB1900	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU50	FB2000	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU51	FB2600	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU52	FA0400	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.141E-14	0.00E+00	0.00E+00
SU01	FR0100	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.2116E-13	0.00E+00	0.00E+00
SU02	FR0100	2	Co-60	5.08E-02	1.49E-02	1.62E+12	3.2116E-13	5.21E-01	4.16E-07
SU03	FR0100	3	Co-60	0.00E+00	0.00E+00	0.00E+00	3.2116E-13	0.00E+00	0.00E+00
SU04	FR0111	8	Co-60	0.00E+00	0.00E+00	0.00E+00	3.2116E-13	0.00E+00	0.00E+00
SU05	FR0111	9	Co-60	5.78E-02	1.69E-02	1.84E+12	3.2116E-13	5.92E-01	4.74E-07
SU06	FR0111	10	Co-60	7.18E-02	2.10E-02	2.29E+12	3.2116E-13	7.36E-01	5.89E-07
SU07	FR0111	11	Co-60	6.54E-02	1.92E-02	2.09E+12	3.2116E-13	6.70E-01	5.36E-07
SU08	FR0111	12	Co-60	6.05E-02	1.77E-02	1.93E+12	3.2116E-13	6.20E-01	4.96E-07
SU09	FR0111	13	Co-60	0.00E+00	0.00E+00	0.00E+00	3.2116E-13	0.00E+00	0.00E+00
SU10	FR0111	14	Co-60	5.23E-02	1.53E-02	1.67E+12	3.2116E-13	5.36E-01	4.29E-07
SU11	FR0111	15	Co-60	5.99E-02	1.75E-02	1.91E+12	3.2116E-13	6.14E-01	4.91E-07
SU12	FR0111	16	Co-60	7.92E-02	2.32E-02	2.53E+12	3.2116E-13	8.12E-01	6.49E-07
SU13	FR0111	17	Co-60	5.48E-02	1.60E-02	1.75E+12	3.2116E-13	5.62E-01	4.49E-07
SU14	FR0111	18	Co-60	0.00E+00	0.00E+00	0.00E+00	3.2116E-13	0.00E+00	0.00E+00
SU15	FR0111	19	Co-60	0.00E+00	0.00E+00	0.00E+00	3.2116E-13	0.00E+00	0.00E+00
SU16	FR0111	20	Co-60	8.66E-02	2.54E-02	2.76E+12	3.2116E-13	8.88E-01	7.10E-07
SU17	FR0200	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.2116E-13	0.00E+00	0.00E+00
SU18	FR0200	2	Co-60	0.00E+00	0.00E+00	0.00E+00	3.2116E-13	0.00E+00	0.00E+00
SU19	FR0200	3	Co-60	0.00E+00	0.00E+00	0.00E+00	3.2116E-13	0.00E+00	0.00E+00
SU20	FR0200	4	Co-60	5.43E-02	1.59E-02	1.73E+12	3.2116E-13	5.56E-01	4.45E-07
SU21	FR0200	5	Co-60	6.39E-02	1.87E-02	2.04E+12	3.2116E-13	6.55E-01	5.24E-07
SU22	FR0200	6	Co-60	5.93E-02	1.74E-02	1.89E+12	3.2116E-13	6.08E-01	4.86E-07
SU23	FR0200	7	Co-60	6.76E-02	1.98E-02	2.16E+12	3.2116E-13	6.93E-01	5.54E-07
SU24	FR0200	8	Co-60	5.49E-02	1.61E-02	1.75E+12	3.2116E-13	5.63E-01	4.50E-07
SU25	FR0200	9	Co-60	7.76E-02	2.27E-02	2.48E+12	3.2116E-13	7.95E-01	6.36E-07
SU26	FR0400	1	Co-60	5.45E-01	1.60E-01	1.74E+13	3.2116E-13	5.59E+00	4.47E-06
SU27	FR0400	2	Co-60	7.34E-02	2.15E-02	2.34E+12	3.2116E-13	7.52E-01	6.02E-07
SU30	FR0500	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.2116E-13	0.00E+00	0.00E+00
SU31	FR0500	2	Co-60	0.00E+00	0.00E+00	0.00E+00	3.2116E-13	0.00E+00	0.00E+00
SU32	FR0800	1	Co-60	7.79E-02	2.28E-02	2.49E+12	3.2116E-13	7.98E-01	6.39E-07
SU33	FR0810	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.2116E-13	0.00E+00	0.00E+00

TABLE E-9

Estimation of Total Dose and Risk from External Exposure from Radionuclides, Onsite Worker Exposure Scenario, (FGR12 Dose-to-Risk Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Exposure Rate from Soil (pCi - s/m ³)	Dose Conversion Factor (mrem/pCi)	Total Dose (mrem)	Increased Lifetime Cancer Risk
SU34	FR0900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.2116E-13	0.00E+00	0.00E+00
SU35	FR0900	2	Co-60	0.00E+00	0.00E+00	0.00E+00	3.2116E-13	0.00E+00	0.00E+00
SU36	FR0900	3	Co-60	0.00E+00	0.00E+00	0.00E+00	3.2116E-13	0.00E+00	0.00E+00
SU37	FR0900	4	Co-60	6.54E-02	1.92E-02	2.09E+12	3.2116E-13	6.70E-01	5.36E-07
SU38	FR0910	1	Co-60	7.72E-02	2.26E-02	2.46E+12	3.2116E-13	7.91E-01	6.33E-07
SU39	FR1000	0	Co-60	2.69E-01	7.88E-02	8.58E+12	3.2116E-13	2.76E+00	2.21E-06
SU40	FR1800	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.2116E-13	0.00E+00	0.00E+00
SU41	FR1800	2	Co-60	0.00E+00	0.00E+00	0.00E+00	3.2116E-13	0.00E+00	0.00E+00
SU42	FR1800	3	Co-60	0.00E+00	0.00E+00	0.00E+00	3.2116E-13	0.00E+00	0.00E+00
SU43	FR2900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.2116E-13	0.00E+00	0.00E+00
SU44	FR2900	2	Co-60	4.20E-02	1.23E-02	1.34E+12	3.2116E-13	4.30E-01	3.44E-07
SU45	FR2900	3	Co-60	0.00E+00	0.00E+00	0.00E+00	3.2116E-13	0.00E+00	0.00E+00
SU46	FB1400	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.2116E-13	0.00E+00	0.00E+00
SU47	FB1500	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.2116E-13	0.00E+00	0.00E+00
SU48	FB1700	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.2116E-13	0.00E+00	0.00E+00
SU49	FB1900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.2116E-13	0.00E+00	0.00E+00
SU50	FB2000	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.2116E-13	0.00E+00	0.00E+00
SU51	FB2600	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.2116E-13	0.00E+00	0.00E+00
SU52	FA0400	1	Co-60	1.33E-01	3.90E-02	4.24E+12	3.2116E-13	1.36E+00	1.09E-06

TABLE E-10

Estimation of Total Dose and Risk from Radionuclides, Construction Worker Exposure Scenario, (FGR 11/12 Dose-to-Risk Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Total Dose Over Exposure Duration (mrem)			Excess Lifetime Cancer Risk			Total Radionuclide Excess Lifetime Cancer Risk	
						Soil Ingestion	External Exposure	Total	Soil Ingestion	External Exposure	Total		Total Risk
SU01	FR0100	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU02	FR0100	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.10E-08	
SU03	FR0100	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU04	FR0111	8	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU05	FR0111	9	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.22E-08	
SU06	FR0111	10	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.15E-07	
SU07	FR0111	11	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E-07	
SU08	FR0111	12	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.65E-08	
SU09	FR0111	13	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU10	FR0111	14	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.34E-08	
SU11	FR0111	15	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.56E-08	
SU12	FR0111	16	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.26E-07	
SU13	FR0111	17	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.74E-08	
SU14	FR0111	18	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU15	FR0111	19	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU16	FR0111	20	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.38E-07	
SU17	FR0200	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU18	FR0200	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU19	FR0200	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU20	FR0200	4	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.66E-08	
SU21	FR0200	5	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.02E-07	
SU22	FR0200	6	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.46E-08	
SU23	FR0200	7	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.08E-07	
SU24	FR0200	8	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.76E-08	
SU25	FR0200	9	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.24E-07	
SU26	FR0400	1	Cs-137	1.24E-01	1.23E-01	3.23E-04	5.80E-02	5.83E-02	2.59E-10	4.64E-08	4.66E-08	9.16E-07	
SU27	FR0400	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.17E-07	
SU30	FR0500	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU31	FR0500	2	Cs-137	2.26E-01	2.23E-01	5.89E-04	1.06E-01	1.06E-01	4.71E-10	8.45E-08	8.50E-08	8.50E-08	
SU32	FR0800	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.24E-07	
SU33	FR0810	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU34	FR0900	1	Cs-137	1.30E-02	1.29E-02	3.39E-05	6.08E-03	6.11E-03	2.71E-11	4.86E-09	4.89E-09	4.89E-09	
SU35	FR0900	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU36	FR0900	3	Cs-137	1.67E-01	1.65E-01	4.35E-04	7.81E-02	7.85E-02	3.48E-10	6.24E-08	6.28E-08	6.28E-08	
SU37	FR0900	4	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E-07	
SU38	FR0910	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.23E-07	
SU39	FR1000	0	Cs-137	1.62E-01	1.60E-01	4.22E-04	7.57E-02	7.61E-02	3.38E-10	6.06E-08	6.09E-08	4.90E-07	
SU40	FR1800	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU41	FR1800	2	Cs-137	4.10E-02	4.05E-02	1.07E-04	1.92E-02	1.93E-02	8.55E-11	1.53E-08	1.54E-08	1.54E-08	
SU42	FR1800	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU43	FR2900	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU44	FR2900	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.70E-08	
SU45	FR2900	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU46	FB1400	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU47	FB1500	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	

TABLE E-10

Estimation of Total Dose and Risk from Radionuclides, Construction Worker Exposure Scenario, (FGR 11/12 Dose-to-Risk Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Total Dose Over Exposure Duration (mrem)			Excess Lifetime Cancer Risk			Total Radionuclide Excess Lifetime Cancer Risk	
						Soil Ingestion	External Exposure	Total	Soil Ingestion	External Exposure	Total		
SU48	FB1700	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU49	FB1900	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU50	FB2000	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU51	FB2600	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU52	FA0400	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.12E-07
												9.16E-07 MAX	
SU01	FR0100	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU02	FR0100	2	Co-60	5.08E-02	4.76E-02	6.77E-05	1.01E-01	1.01E-01	5.42E-11	8.10E-08	8.10E-08	8.10E-08	8.10E-08
SU03	FR0100	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU04	FR0111	8	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU05	FR0111	9	Co-60	5.78E-02	5.42E-02	7.70E-05	1.15E-01	1.15E-01	6.16E-11	9.21E-08	9.22E-08	9.22E-08	9.22E-08
SU06	FR0111	10	Co-60	7.18E-02	6.73E-02	9.57E-05	1.43E-01	1.43E-01	7.65E-11	1.14E-07	1.15E-07	1.15E-07	1.15E-07
SU07	FR0111	11	Co-60	6.54E-02	6.13E-02	8.72E-05	1.30E-01	1.30E-01	6.97E-11	1.04E-07	1.04E-07	1.04E-07	1.04E-07
SU08	FR0111	12	Co-60	6.05E-02	5.67E-02	8.06E-05	1.21E-01	1.21E-01	6.45E-11	9.64E-08	9.65E-08	9.65E-08	9.65E-08
SU09	FR0111	13	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU10	FR0111	14	Co-60	5.23E-02	4.90E-02	6.97E-05	1.04E-01	1.04E-01	5.58E-11	8.34E-08	8.34E-08	8.34E-08	8.34E-08
SU11	FR0111	15	Co-60	5.99E-02	5.61E-02	7.98E-05	1.19E-01	1.19E-01	6.39E-11	9.55E-08	9.56E-08	9.56E-08	9.56E-08
SU12	FR0111	16	Co-60	7.92E-02	7.42E-02	1.06E-04	1.58E-01	1.58E-01	8.44E-11	1.26E-07	1.26E-07	1.26E-07	1.26E-07
SU13	FR0111	17	Co-60	5.48E-02	5.14E-02	7.30E-05	1.09E-01	1.09E-01	5.84E-11	8.74E-08	8.74E-08	8.74E-08	8.74E-08
SU14	FR0111	18	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU15	FR0111	19	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU16	FR0111	20	Co-60	8.66E-02	8.11E-02	1.15E-04	1.73E-01	1.73E-01	9.23E-11	1.38E-07	1.38E-07	1.38E-07	1.38E-07
SU17	FR0200	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU18	FR0200	2	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU19	FR0200	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU20	FR0200	4	Co-60	5.43E-02	5.09E-02	7.24E-05	1.08E-01	1.08E-01	5.79E-11	8.66E-08	8.66E-08	8.66E-08	8.66E-08
SU21	FR0200	5	Co-60	6.39E-02	5.99E-02	8.52E-05	1.27E-01	1.27E-01	6.81E-11	1.02E-07	1.02E-07	1.02E-07	1.02E-07
SU22	FR0200	6	Co-60	5.93E-02	5.56E-02	7.90E-05	1.18E-01	1.18E-01	6.32E-11	9.45E-08	9.46E-08	9.46E-08	9.46E-08
SU23	FR0200	7	Co-60	6.76E-02	6.33E-02	9.01E-05	1.35E-01	1.35E-01	7.21E-11	1.08E-07	1.08E-07	1.08E-07	1.08E-07
SU24	FR0200	8	Co-60	5.49E-02	5.14E-02	7.32E-05	1.09E-01	1.09E-01	5.85E-11	8.75E-08	8.76E-08	8.76E-08	8.76E-08
SU25	FR0200	9	Co-60	7.76E-02	7.27E-02	1.03E-04	1.55E-01	1.55E-01	8.27E-11	1.24E-07	1.24E-07	1.24E-07	1.24E-07
SU26	FR0400	1	Co-60	5.45E-01	5.11E-01	7.26E-04	1.09E+00	1.09E+00	5.81E-10	8.69E-07	8.69E-07	8.69E-07	8.69E-07
SU27	FR0400	2	Co-60	7.34E-02	6.88E-02	9.78E-05	1.46E-01	1.46E-01	7.83E-11	1.17E-07	1.17E-07	1.17E-07	1.17E-07
SU30	FR0500	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU31	FR0500	2	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU32	FR0800	1	Co-60	7.79E-02	7.30E-02	1.04E-04	1.55E-01	1.55E-01	8.31E-11	1.24E-07	1.24E-07	1.24E-07	1.24E-07
SU33	FR0810	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU34	FR0900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU35	FR0900	2	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU36	FR0900	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU37	FR0900	4	Co-60	6.54E-02	6.13E-02	8.72E-05	1.30E-01	1.30E-01	6.97E-11	1.04E-07	1.04E-07	1.04E-07	1.04E-07
SU38	FR0910	1	Co-60	7.72E-02	7.23E-02	1.03E-04	1.54E-01	1.54E-01	8.23E-11	1.23E-07	1.23E-07	1.23E-07	1.23E-07
SU39	FR1000	0	Co-60	2.69E-01	2.52E-01	3.58E-04	5.36E-01	5.36E-01	2.87E-10	4.29E-07	4.29E-07	4.29E-07	4.29E-07

TABLE E-10

Estimation of Total Dose and Risk from Radionuclides, Construction Worker Exposure Scenario, (FGR 11/12 Dose-to-Risk Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Total Dose Over Exposure Duration (mrem)			Excess Lifetime Cancer Risk		
						Soil Ingestion	External Exposure	Total	Soil Ingestion	External Exposure	Total
SU40	FR1800	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU41	FR1800	2	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU42	FR1800	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU43	FR2900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU44	FR2900	2	Co-60	4.20E-02	3.94E-02	5.60E-05	8.37E-02	8.37E-02	4.48E-11	6.70E-08	6.70E-08
SU45	FR2900	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU46	FB1400	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU47	FB1500	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU48	FB1700	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU49	FB1900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU50	FB2000	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU51	FB2600	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU52	FA0400	1	Co-60	1.33E-01	1.25E-01	1.77E-04	2.65E-01	2.65E-01	1.42E-10	2.12E-07	2.12E-07

TABLE E-11

Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Construction Worker Exposure Scenario, (FGR11 Dose-to-Risk Methodology)
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

$$Intake_{si} = C_e \times IR_{si} \times 0.001 \times EF \times ED$$

$$Dose_{si} = Intake_{si} \times DCF_i$$

$$ILCR = Dose_{si} \times CF$$

Parameter	Units	Value	Description
Intake _{si}	pCi	Calculated	Radionuclide exposure through soil ingestion
C _e	pCi/g	Nuclide-specific	Exposure concentration in soil
IR _{si}	mg/day	330	Soil ingestion rate (0.001 g/mg is a conversion factor)
EF	days/year	160	Exposure frequency
ED	years	1	Exposure duration
DCF _i	mrem/pCi	Nuclide-specific	Dose conversion factor for ingestion (from FGR 11)
ILCR	unitless	Calculated	Increased lifetime cancer risk
CF	risk/mrem	8.00E-07	Dose to risk conversion factor

Radionuclide	Dose Conversion Factor (mrem/pCi)
Cs-137	5.00E-05
Co-60	2.69E-05

TABLE E-11

Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Construction Worker Exposure Scenario, (FGR11 Dose-to-Risk Methodology

*Cumulative Risk Assessment**Maine Yankee Facility, Wiscasset, ME*

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Dose Conversion Factor (mrem/pCi)	Total Dose (mrem)	Increased Lifetime Cancer Risk
SU01	FR0100	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU02	FR0100	2	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU03	FR0100	3	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU04	FR0111	8	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU05	FR0111	9	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU06	FR0111	10	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU07	FR0111	11	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU08	FR0111	12	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU09	FR0111	13	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU10	FR0111	14	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU11	FR0111	15	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU12	FR0111	16	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU13	FR0111	17	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU14	FR0111	18	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU15	FR0111	19	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU16	FR0111	20	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU17	FR0200	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU18	FR0200	2	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU19	FR0200	3	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU20	FR0200	4	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU21	FR0200	5	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU22	FR0200	6	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU23	FR0200	7	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU24	FR0200	8	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU25	FR0200	9	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU26	FR0400	1	Cs-137	1.24E-01	1.23E-01	5.00E-05	3.23E-04	2.59E-10
SU27	FR0400	2	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU30	FR0500	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU31	FR0500	2	Cs-137	2.26E-01	2.23E-01	5.00E-05	5.89E-04	4.71E-10
SU32	FR0800	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU33	FR0810	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU34	FR0900	1	Cs-137	1.30E-02	1.29E-02	5.00E-05	3.39E-05	2.71E-11
SU35	FR0900	2	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU36	FR0900	3	Cs-137	1.67E-01	1.65E-01	5.00E-05	4.35E-04	3.48E-10
SU37	FR0900	4	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU38	FR0910	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU39	FR1000	0	Cs-137	1.62E-01	1.60E-01	5.00E-05	4.22E-04	3.38E-10
SU40	FR1800	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00

TABLE E-11

Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Construction Worker Exposure Scenario, (FGR11 Dose-to-Risk Methodology

*Cumulative Risk Assessment**Maine Yankee Facility, Wiscasset, ME*

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Dose Conversion Factor (mrem/pCi)	Total Dose (mrem)	Increased Lifetime Cancer Risk
SU41	FR1800	2	Cs-137	4.10E-02	4.05E-02	5.00E-05	1.07E-04	8.55E-11
SU42	FR1800	3	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU43	FR2900	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU44	FR2900	2	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU45	FR2900	3	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU46	FB1400	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU47	FB1500	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU48	FB1700	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU49	FB1900	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU50	FB2000	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU51	FB2600	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU52	FA0400	1	Cs-137	0.00E+00	0.00E+00	5.00E-05	0.00E+00	0.00E+00
SU01	FR0100	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU02	FR0100	2	Co-60	5.08E-02	4.76E-02	2.69E-05	6.77E-05	5.42E-11
SU03	FR0100	3	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU04	FR0111	8	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU05	FR0111	9	Co-60	5.78E-02	5.42E-02	2.69E-05	7.70E-05	6.16E-11
SU06	FR0111	10	Co-60	7.18E-02	6.73E-02	2.69E-05	9.57E-05	7.65E-11
SU07	FR0111	11	Co-60	6.54E-02	6.13E-02	2.69E-05	8.72E-05	6.97E-11
SU08	FR0111	12	Co-60	6.05E-02	5.67E-02	2.69E-05	8.06E-05	6.45E-11
SU09	FR0111	13	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU10	FR0111	14	Co-60	5.23E-02	4.90E-02	2.69E-05	6.97E-05	5.58E-11
SU11	FR0111	15	Co-60	5.99E-02	5.61E-02	2.69E-05	7.98E-05	6.39E-11
SU12	FR0111	16	Co-60	7.92E-02	7.42E-02	2.69E-05	1.06E-04	8.44E-11
SU13	FR0111	17	Co-60	5.48E-02	5.14E-02	2.69E-05	7.30E-05	5.84E-11
SU14	FR0111	18	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU15	FR0111	19	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU16	FR0111	20	Co-60	8.66E-02	8.11E-02	2.69E-05	1.15E-04	9.23E-11
SU17	FR0200	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU18	FR0200	2	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU19	FR0200	3	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU20	FR0200	4	Co-60	5.43E-02	5.09E-02	2.69E-05	7.24E-05	5.79E-11
SU21	FR0200	5	Co-60	6.39E-02	5.99E-02	2.69E-05	8.52E-05	6.81E-11
SU22	FR0200	6	Co-60	5.93E-02	5.56E-02	2.69E-05	7.90E-05	6.32E-11
SU23	FR0200	7	Co-60	6.76E-02	6.33E-02	2.69E-05	9.01E-05	7.21E-11
SU24	FR0200	8	Co-60	5.49E-02	5.14E-02	2.69E-05	7.32E-05	5.85E-11
SU25	FR0200	9	Co-60	7.76E-02	7.27E-02	2.69E-05	1.03E-04	8.27E-11

TABLE E-11

Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Construction Worker Exposure Scenario, (FGR11 Dose-to-Risk Methodology

*Cumulative Risk Assessment**Maine Yankee Facility, Wiscasset, ME*

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Dose Conversion Factor (mrem/pCi)	Total Dose (mrem)	Increased Lifetime Cancer Risk
SU26	FR0400	1	Co-60	5.45E-01	5.11E-01	2.69E-05	7.26E-04	5.81E-10
SU27	FR0400	2	Co-60	7.34E-02	6.88E-02	2.69E-05	9.78E-05	7.83E-11
SU30	FR0500	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU31	FR0500	2	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU32	FR0800	1	Co-60	7.79E-02	7.30E-02	2.69E-05	1.04E-04	8.31E-11
SU33	FR0810	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU34	FR0900	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU35	FR0900	2	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU36	FR0900	3	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU37	FR0900	4	Co-60	6.54E-02	6.13E-02	2.69E-05	8.72E-05	6.97E-11
SU38	FR0910	1	Co-60	7.72E-02	7.23E-02	2.69E-05	1.03E-04	8.23E-11
SU39	FR1000	0	Co-60	2.69E-01	2.52E-01	2.69E-05	3.58E-04	2.87E-10
SU40	FR1800	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU41	FR1800	2	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU42	FR1800	3	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU43	FR2900	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU44	FR2900	2	Co-60	4.20E-02	3.94E-02	2.69E-05	5.60E-05	4.48E-11
SU45	FR2900	3	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU46	FB1400	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU47	FB1500	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU48	FB1700	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU49	FB1900	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU50	FB2000	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU51	FB2600	1	Co-60	0.00E+00	0.00E+00	2.69E-05	0.00E+00	0.00E+00
SU52	FA0400	1	Co-60	1.33E-01	1.25E-01	2.69E-05	1.77E-04	1.42E-10

TABLE E-12

Estimation of Total Dose and Risk from External Exposure from Radionuclides, Construction Worker Exposure Scenario, (FGR12 Dose-to-Risk Methodology)
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

$$E = C \times \left(\frac{EF}{365} \right) \times ED \times BD \times 1E+06 \times 3.15E+07 \times ACF \times [ET_o + (ET_i \times GSF)]$$

$$Dose_e = E \times DCF$$

$$ILCR = Dose_e \times CF$$

Parameter	Units	Value	Description
E	pCi - s/m ³	Calculated	Exposure rate from soil
C	pCi/g	Input	Concentration in soil, averaged over exposure duration
EF	days/year	160	Exposure frequency
ED	years	1	Exposure duration
BD	g/cm ³	1.60	Bulk density of soil
ACF	unitless	0.90	Area correction factor
ET _o	unitless	0.333	Exposure time outdoors
ET _i	unitless	0.000	Exposure time indoors
GSF	unitless	0.40	Indoor gamma shielding factor
DCF _i	mrem/pCi	Nuclide-specific	Dose conversion factor for ingestion (from FGR 11)
ILCR	unitless	Calculated	Increased lifetime cancer risk
CF	risk/mrem	8.00E-07	Dose to risk conversion factor
1.00E+06	cm ³ /m ³		Conversion factor
3.15E+07	s/year		Conversion factor

Notes:

ET_o value assumes an 8 hour work day, where 100% of the time is spent outdoors. (8/24)*100%=0.333
 ET_i value assumes an 8 hour work day, where no hours are spent indoors.

Radionuclide	Dose Conversion Factor (mrem/pCi)
Cs-137	7.14E-14
Co-60	3.21E-13

TABLE E-12

Estimation of Total Dose and Risk from External Exposure from Radionuclides, Construction Worker Exposure Scenario, (FGR12 Dose-to-Risk Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Exposure Rate from Soil (pCi - s/m ³)	Dose Conversion Factor (mrem/pCi)	Total Dose (mrem)	Increased Lifetime Cancer Risk
SU01	FR0100	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU02	FR0100	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU03	FR0100	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU04	FR0111	8	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU05	FR0111	9	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU06	FR0111	10	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU07	FR0111	11	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU08	FR0111	12	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU09	FR0111	13	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU10	FR0111	14	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU11	FR0111	15	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU12	FR0111	16	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU13	FR0111	17	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU14	FR0111	18	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU15	FR0111	19	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU16	FR0111	20	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU17	FR0200	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU18	FR0200	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU19	FR0200	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU20	FR0200	4	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU21	FR0200	5	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU22	FR0200	6	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU23	FR0200	7	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU24	FR0200	8	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU25	FR0200	9	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU26	FR0400	1	Cs-137	1.24E-01	1.23E-01	8.12E+11	7.14E-14	5.80E-02	4.64E-08
SU27	FR0400	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU30	FR0500	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU31	FR0500	2	Cs-137	2.26E-01	2.23E-01	1.48E+12	7.14E-14	1.06E-01	8.45E-08
SU32	FR0800	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU33	FR0810	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU34	FR0900	1	Cs-137	1.30E-02	1.29E-02	8.51E+10	7.14E-14	6.08E-03	4.86E-09
SU35	FR0900	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU36	FR0900	3	Cs-137	1.67E-01	1.65E-01	1.09E+12	7.14E-14	7.81E-02	6.24E-08
SU37	FR0900	4	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU38	FR0910	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU39	FR1000	0	Cs-137	1.62E-01	1.60E-01	1.06E+12	7.14E-14	7.57E-02	6.06E-08
SU40	FR1800	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU41	FR1800	2	Cs-137	4.10E-02	4.05E-02	2.68E+11	7.14E-14	1.92E-02	1.53E-08
SU42	FR1800	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU43	FR2900	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU44	FR2900	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00

TABLE E-12

Estimation of Total Dose and Risk from External Exposure from Radionuclides, Construction Worker Exposure Scenario, (FGR12 Dose-to-Risk Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Exposure Rate from Soil (pCi - s/m ³)	Dose Conversion Factor (mrem/pCi)	Total Dose (mrem)	Increased Lifetime Cancer Risk
SU45	FR2900	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU46	FB1400	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU47	FB1500	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU48	FB1700	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU49	FB1900	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU50	FB2000	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU51	FB2600	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU52	FA0400	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	7.14E-14	0.00E+00	0.00E+00
SU01	FR0100	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU02	FR0100	2	Co-60	5.08E-02	4.76E-02	3.15E+11	3.21E-13	1.01E-01	8.10E-08
SU03	FR0100	3	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU04	FR0111	8	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU05	FR0111	9	Co-60	5.78E-02	5.42E-02	3.59E+11	3.21E-13	1.15E-01	9.21E-08
SU06	FR0111	10	Co-60	7.18E-02	6.73E-02	4.45E+11	3.21E-13	1.43E-01	1.14E-07
SU07	FR0111	11	Co-60	6.54E-02	6.13E-02	4.06E+11	3.21E-13	1.30E-01	1.04E-07
SU08	FR0111	12	Co-60	6.05E-02	5.67E-02	3.75E+11	3.21E-13	1.21E-01	9.64E-08
SU09	FR0111	13	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU10	FR0111	14	Co-60	5.23E-02	4.90E-02	3.24E+11	3.21E-13	1.04E-01	8.34E-08
SU11	FR0111	15	Co-60	5.99E-02	5.61E-02	3.72E+11	3.21E-13	1.19E-01	9.55E-08
SU12	FR0111	16	Co-60	7.92E-02	7.42E-02	4.91E+11	3.21E-13	1.58E-01	1.26E-07
SU13	FR0111	17	Co-60	5.48E-02	5.14E-02	3.40E+11	3.21E-13	1.09E-01	8.74E-08
SU14	FR0111	18	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU15	FR0111	19	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU16	FR0111	20	Co-60	8.66E-02	8.11E-02	5.37E+11	3.21E-13	1.73E-01	1.38E-07
SU17	FR0200	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU18	FR0200	2	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU19	FR0200	3	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU20	FR0200	4	Co-60	5.43E-02	5.09E-02	3.37E+11	3.21E-13	1.08E-01	8.66E-08
SU21	FR0200	5	Co-60	6.39E-02	5.99E-02	3.96E+11	3.21E-13	1.27E-01	1.02E-07
SU22	FR0200	6	Co-60	5.93E-02	5.56E-02	3.68E+11	3.21E-13	1.18E-01	9.45E-08
SU23	FR0200	7	Co-60	6.76E-02	6.33E-02	4.19E+11	3.21E-13	1.35E-01	1.08E-07
SU24	FR0200	8	Co-60	5.49E-02	5.14E-02	3.41E+11	3.21E-13	1.09E-01	8.75E-08
SU25	FR0200	9	Co-60	7.76E-02	7.27E-02	4.81E+11	3.21E-13	1.55E-01	1.24E-07
SU26	FR0400	1	Co-60	5.45E-01	5.11E-01	3.38E+12	3.21E-13	1.09E+00	8.69E-07
SU27	FR0400	2	Co-60	7.34E-02	6.88E-02	4.55E+11	3.21E-13	1.46E-01	1.17E-07
SU30	FR0500	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU31	FR0500	2	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU32	FR0800	1	Co-60	7.79E-02	7.30E-02	4.83E+11	3.21E-13	1.55E-01	1.24E-07
SU33	FR0810	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU34	FR0900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00

TABLE E-12

Estimation of Total Dose and Risk from External Exposure from Radionuclides, Construction Worker Exposure Scenario, (FGR12 Dose-to-Risk Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Exposure Rate from Soil (pCi - s/m ³)	Dose Conversion Factor (mrem/pCi)	Total Dose (mrem)	Increased Lifetime Cancer Risk
SU35	FR0900	2	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU36	FR0900	3	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU37	FR0900	4	Co-60	6.54E-02	6.13E-02	4.06E+11	3.21E-13	1.30E-01	1.04E-07
SU38	FR0910	1	Co-60	7.72E-02	7.23E-02	4.79E+11	3.21E-13	1.54E-01	1.23E-07
SU39	FR1000	0	Co-60	2.69E-01	2.52E-01	1.67E+12	3.21E-13	5.36E-01	4.29E-07
SU40	FR1800	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU41	FR1800	2	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU42	FR1800	3	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU43	FR2900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU44	FR2900	2	Co-60	4.20E-02	3.94E-02	2.61E+11	3.21E-13	8.37E-02	6.70E-08
SU45	FR2900	3	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU46	FB1400	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU47	FB1500	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU48	FB1700	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU49	FB1900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU50	FB2000	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU51	FB2600	1	Co-60	0.00E+00	0.00E+00	0.00E+00	3.21E-13	0.00E+00	0.00E+00
SU52	FA0400	1	Co-60	1.33E-01	1.25E-01	8.25E+11	3.21E-13	2.65E-01	2.12E-07

TABLE E-13

Estimation of Total Dose and Risk from Radionuclides, Onsite Resident Exposure Scenario, (FGR13/HEAST Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Excess Lifetime Cancer Risk				Total Radionuclide Excess Lifetime Cancer Risk
						Soil Ingestion	Crop Ingestion	External Exposure		
								Total	Total	
SU01	FR0100	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU02	FR0100	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.42E-06
SU03	FR0100	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU04	FR0111	8	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU05	FR0111	9	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.62E-06
SU06	FR0111	10	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.01E-06
SU07	FR0111	11	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.83E-06
SU08	FR0111	12	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.69E-06
SU09	FR0111	13	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU10	FR0111	14	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.46E-06
SU11	FR0111	15	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.68E-06
SU12	FR0111	16	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.22E-06
SU13	FR0111	17	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.53E-06
SU14	FR0111	18	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU15	FR0111	19	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU16	FR0111	20	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.42E-06
SU17	FR0200	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU18	FR0200	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU19	FR0200	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU20	FR0200	4	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.52E-06
SU21	FR0200	5	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.79E-06
SU22	FR0200	6	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.66E-06
SU23	FR0200	7	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.89E-06
SU24	FR0200	8	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.54E-06
SU25	FR0200	9	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.17E-06
SU26	FR0400	1	Cs-137	1.24E-01	8.96E-02	2.10E-09	1.04E-07	2.05E-06	2.15E-06	1.74E-05
SU27	FR0400	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.05E-06
SU30	FR0500	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU31	FR0500	2	Cs-137	2.26E-01	1.63E-01	3.82E-09	1.89E-07	3.73E-06	3.93E-06	3.93E-06
SU32	FR0800	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.18E-06
SU33	FR0810	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU34	FR0900	1	Cs-137	1.30E-02	9.39E-03	2.20E-10	1.09E-08	2.15E-07	2.26E-07	2.26E-07
SU35	FR0900	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU36	FR0900	3	Cs-137	1.67E-01	1.21E-01	2.82E-09	1.40E-07	2.76E-06	2.90E-06	2.90E-06
SU37	FR0900	4	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.83E-06
SU38	FR0910	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.16E-06
SU39	FR1000	0	Cs-137	1.62E-01	1.17E-01	2.74E-09	1.36E-07	2.68E-06	2.81E-06	1.03E-05
SU40	FR1800	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU41	FR1800	2	Cs-137	4.10E-02	2.96E-02	6.93E-10	3.43E-08	6.77E-07	7.12E-07	7.12E-07

TABLE E-13

Estimation of Total Dose and Risk from Radionuclides, Onsite Resident Exposure Scenario, (FGR13/HEAST Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Excess Lifetime Cancer Risk				Total Radionuclide Excess Lifetime Cancer Risk
						Soil Ingestion	Crop Ingestion	External Exposure	Total	
SU42	FR1800	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU43	FR2900	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU44	FR2900	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.18E-06
SU45	FR2900	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU46	FB1400	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU47	FB1500	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU48	FB1700	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU49	FB1900	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU50	FB2000	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU51	FB2600	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU52	FA0400	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.72E-06
										1.74E-05 MAX
SU01	FR0100	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU02	FR0100	2	Co-60	5.08E-02	1.26E-02	2.75E-10	1.74E-08	1.40E-06	1.42E-06	
SU03	FR0100	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU04	FR0111	8	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU05	FR0111	9	Co-60	5.78E-02	1.44E-02	3.13E-10	1.98E-08	1.60E-06	1.62E-06	
SU06	FR0111	10	Co-60	7.18E-02	1.79E-02	3.88E-10	2.46E-08	1.98E-06	2.01E-06	
SU07	FR0111	11	Co-60	6.54E-02	1.63E-02	3.54E-10	2.25E-08	1.81E-06	1.83E-06	
SU08	FR0111	12	Co-60	6.05E-02	1.50E-02	3.27E-10	2.08E-08	1.67E-06	1.69E-06	
SU09	FR0111	13	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU10	FR0111	14	Co-60	5.23E-02	1.30E-02	2.83E-10	1.80E-08	1.45E-06	1.46E-06	
SU11	FR0111	15	Co-60	5.99E-02	1.49E-02	3.24E-10	2.06E-08	1.66E-06	1.68E-06	
SU12	FR0111	16	Co-60	7.92E-02	1.97E-02	4.29E-10	2.72E-08	2.19E-06	2.22E-06	
SU13	FR0111	17	Co-60	5.48E-02	1.36E-02	2.97E-10	1.88E-08	1.51E-06	1.53E-06	
SU14	FR0111	18	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU15	FR0111	19	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU16	FR0111	20	Co-60	8.66E-02	2.15E-02	4.69E-10	2.97E-08	2.39E-06	2.42E-06	
SU17	FR0200	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU18	FR0200	2	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU19	FR0200	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU20	FR0200	4	Co-60	5.43E-02	1.35E-02	2.94E-10	1.86E-08	1.50E-06	1.52E-06	
SU21	FR0200	5	Co-60	6.39E-02	1.59E-02	3.46E-10	2.19E-08	1.77E-06	1.79E-06	
SU22	FR0200	6	Co-60	5.93E-02	1.47E-02	3.21E-10	2.04E-08	1.64E-06	1.66E-06	
SU23	FR0200	7	Co-60	6.76E-02	1.68E-02	3.66E-10	2.32E-08	1.87E-06	1.89E-06	
SU24	FR0200	8	Co-60	5.49E-02	1.36E-02	2.97E-10	1.88E-08	1.52E-06	1.54E-06	
SU25	FR0200	9	Co-60	7.76E-02	1.93E-02	4.20E-10	2.66E-08	2.14E-06	2.17E-06	
SU26	FR0400	1	Co-60	5.45E-01	1.36E-01	2.95E-09	1.87E-07	1.51E-05	1.53E-05	
SU27	FR0400	2	Co-60	7.34E-02	1.82E-02	3.97E-10	2.52E-08	2.03E-06	2.05E-06	

TABLE E-13

Estimation of Total Dose and Risk from Radionuclides, Onsite Resident Exposure Scenario, (FGR13/HEAST Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Excess Lifetime Cancer Risk				Total Radionuclide Excess Lifetime Cancer Risk
						Soil Ingestion	Crop Ingestion	External Exposure	Total	
SU30	FR0500	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU31	FR0500	2	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU32	FR0800	1	Co-60	7.79E-02	1.94E-02	4.21E-10	2.67E-08	2.15E-06	2.18E-06	
SU33	FR0810	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU34	FR0900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU35	FR0900	2	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU36	FR0900	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU37	FR0900	4	Co-60	6.54E-02	1.63E-02	3.54E-10	2.25E-08	1.81E-06	1.83E-06	
SU38	FR0910	1	Co-60	7.72E-02	1.92E-02	4.18E-10	2.65E-08	2.13E-06	2.16E-06	
SU39	FR1000	0	Co-60	2.69E-01	6.69E-02	1.46E-09	9.23E-08	7.43E-06	7.53E-06	
SU40	FR1800	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU41	FR1800	2	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU42	FR1800	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU43	FR2900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU44	FR2900	2	Co-60	4.20E-02	1.04E-02	2.27E-10	1.44E-08	1.16E-06	1.18E-06	
SU45	FR2900	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU46	FB1400	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU47	FB1500	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU48	FB1700	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU49	FB1900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU50	FB2000	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU51	FB2600	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU52	FA0400	1	Co-60	1.33E-01	3.31E-02	7.20E-10	4.57E-08	3.68E-06	3.72E-06	

TABLE E-14

Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Onsite Resident Exposure Scenario, (FGR13/HEAST Slope Factor Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

$$Intake_{si} = C_e \times IR_{si} \times 0.001 \times EF \times ED$$

$$ILCR = Intake_{si} \times CSF_i$$

Parameter	Units	Value	Description
Intake _{si}	pCi	Calculated	Radionuclide exposure through soil ingestion
C _e	pCi/g	Nuclide-specific	Exposure concentration in soil
IR _{si}	mg/day	120	Soil ingestion rate (0.001 g/mg is a conversion factor)
EF	days/year	150	Exposure frequency
ED	years	30	Exposure duration
CSF _i	pCi ⁻¹	Nuclide-specific	Cancer slope factor
ILCR	unitless	Calculated	Increased lifetime cancer risk

Radionuclide	Cancer Slope Factor (pCi) ⁻¹
Cs-137	4.33E-11
Co-60	4.03E-11

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Intake (pCi)	Cancer Slope Factor (pCi) ⁻¹	Increased Lifetime Cancer Risk
SU01	FR0100	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU02	FR0100	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU03	FR0100	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU04	FR0111	8	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU05	FR0111	9	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU06	FR0111	10	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU07	FR0111	11	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU08	FR0111	12	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU09	FR0111	13	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU10	FR0111	14	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00

TABLE E-14

Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Onsite Resident Exposure Scenario, (FGR13/HEAST Slope Factor Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Intake (pCi)	Cancer Slope Factor (pCi) ⁻¹	Increased Lifetime Cancer Risk
SU11	FR0111	15	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU12	FR0111	16	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU13	FR0111	17	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU14	FR0111	18	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU15	FR0111	19	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU16	FR0111	20	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU17	FR0200	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU18	FR0200	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU19	FR0200	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU20	FR0200	4	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU21	FR0200	5	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU22	FR0200	6	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU23	FR0200	7	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU24	FR0200	8	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU25	FR0200	9	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU26	FR0400	1	Cs-137	1.24E-01	8.96E-02	4.84E+01	4.33E-11	2.10E-09
SU27	FR0400	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU30	FR0500	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU31	FR0500	2	Cs-137	2.26E-01	1.63E-01	8.82E+01	4.33E-11	3.82E-09
SU32	FR0800	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU33	FR0810	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU34	FR0900	1	Cs-137	1.30E-02	9.39E-03	5.07E+00	4.33E-11	2.20E-10
SU35	FR0900	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU36	FR0900	3	Cs-137	1.67E-01	1.21E-01	6.52E+01	4.33E-11	2.82E-09
SU37	FR0900	4	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU38	FR0910	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU39	FR1000	0	Cs-137	1.62E-01	1.17E-01	6.32E+01	4.33E-11	2.74E-09
SU40	FR1800	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU41	FR1800	2	Cs-137	4.10E-02	2.96E-02	1.60E+01	4.33E-11	6.93E-10
SU42	FR1800	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU43	FR2900	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU44	FR2900	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU45	FR2900	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU46	FB1400	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU47	FB1500	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU48	FB1700	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU49	FB1900	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU50	FB2000	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU51	FB2600	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU52	FA0400	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00

TABLE E-14

Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Onsite Resident Exposure Scenario, (FGR13/HEAST Slope Factor Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Intake (pCi)	Cancer Slope Factor (pCi) ⁻¹	Increased Lifetime Cancer Risk
SU01	FR0100	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU02	FR0100	2	Co-60	5.08E-02	1.26E-02	6.82E+00	4.03E-11	2.75E-10
SU03	FR0100	3	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU04	FR0111	8	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU05	FR0111	9	Co-60	5.78E-02	1.44E-02	7.76E+00	4.03E-11	3.13E-10
SU06	FR0111	10	Co-60	7.18E-02	1.79E-02	9.64E+00	4.03E-11	3.88E-10
SU07	FR0111	11	Co-60	6.54E-02	1.63E-02	8.78E+00	4.03E-11	3.54E-10
SU08	FR0111	12	Co-60	6.05E-02	1.50E-02	8.12E+00	4.03E-11	3.27E-10
SU09	FR0111	13	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU10	FR0111	14	Co-60	5.23E-02	1.30E-02	7.02E+00	4.03E-11	2.83E-10
SU11	FR0111	15	Co-60	5.99E-02	1.49E-02	8.04E+00	4.03E-11	3.24E-10
SU12	FR0111	16	Co-60	7.92E-02	1.97E-02	1.06E+01	4.03E-11	4.29E-10
SU13	FR0111	17	Co-60	5.48E-02	1.36E-02	7.36E+00	4.03E-11	2.97E-10
SU14	FR0111	18	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU15	FR0111	19	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU16	FR0111	20	Co-60	8.66E-02	2.15E-02	1.16E+01	4.03E-11	4.69E-10
SU17	FR0200	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU18	FR0200	2	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU19	FR0200	3	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU20	FR0200	4	Co-60	5.43E-02	1.35E-02	7.29E+00	4.03E-11	2.94E-10
SU21	FR0200	5	Co-60	6.39E-02	1.59E-02	8.58E+00	4.03E-11	3.46E-10
SU22	FR0200	6	Co-60	5.93E-02	1.47E-02	7.96E+00	4.03E-11	3.21E-10
SU23	FR0200	7	Co-60	6.76E-02	1.68E-02	9.08E+00	4.03E-11	3.66E-10
SU24	FR0200	8	Co-60	5.49E-02	1.36E-02	7.37E+00	4.03E-11	2.97E-10
SU25	FR0200	9	Co-60	7.76E-02	1.93E-02	1.04E+01	4.03E-11	4.20E-10
SU26	FR0400	1	Co-60	5.45E-01	1.36E-01	7.32E+01	4.03E-11	2.95E-09
SU27	FR0400	2	Co-60	7.34E-02	1.82E-02	9.85E+00	4.03E-11	3.97E-10
SU30	FR0500	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU31	FR0500	2	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU32	FR0800	1	Co-60	7.79E-02	1.94E-02	1.05E+01	4.03E-11	4.21E-10
SU33	FR0810	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU34	FR0900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU35	FR0900	2	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU36	FR0900	3	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU37	FR0900	4	Co-60	6.54E-02	1.63E-02	8.78E+00	4.03E-11	3.54E-10
SU38	FR0910	1	Co-60	7.72E-02	1.92E-02	1.04E+01	4.03E-11	4.18E-10
SU39	FR1000	0	Co-60	2.69E-01	6.69E-02	3.61E+01	4.03E-11	1.46E-09
SU40	FR1800	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU41	FR1800	2	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU42	FR1800	3	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU43	FR2900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00

TABLE E-14

Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Onsite Resident Exposure Scenario, (FGR13/HEAST Slope Factor Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Intake (pCi)	Cancer Slope Factor (pCi) ⁻¹	Increased Lifetime Cancer Risk
SU44	FR2900	2	Co-60	4.20E-02	1.04E-02	5.64E+00	4.03E-11	2.27E-10
SU45	FR2900	3	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU46	FB1400	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU47	FB1500	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU48	FB1700	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU49	FB1900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU50	FB2000	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU51	FB2600	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU52	FA0400	1	Co-60	1.33E-01	3.31E-02	1.79E+01	4.03E-11	7.20E-10

TABLE E-15
 Estimation of Total Dose and Risk from Crop Ingestion from Radionuclides, Onsite Resident Exposure Scenario, (FGR-13/HEAST Methodology)
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

$$Intake_{ci} = C_e \times \left[(IR_f \times B_f) + (IR_v \times B_v) + (IR_{lv} \times B_{lv}) \right] \times 1000 \times CPF \times ED$$

$$ILCR = Intake_{ci} \times CSF$$

Parameter	Units	Value	Description
IR_f	kg/yr	7.7	Exposed aboveground produce ingestion rate
IR_v	kg/yr	18.1	Protected & root produce ingestion rate
IR_{lv}	kg/yr		Leafy vegetable ingestion rate
CPF	unitless	1	Contaminated plant fraction from site
ED	years	30	Exposure Duration
B_f	unitless	nuclide-specific	Soil-to-plant transfer coefficient, for fruit - converted to fresh weight basis
B_v	unitless	nuclide-specific	Soil-to-plant transfer coefficient, for protected/root vegetables
B_{lv}	unitless	nuclide-specific	Soil-to-plant transfer coefficient, for leafy vegetables
CSF		nuclide-specific	Cancer slope factor

Radionuclide	Cancer Slope Factor (pCi) ⁻¹	Soil-to-plant transfer coefficient - fruit	Soil-to-plant transfer coefficient - root vegetables	Soil-to-plant transfer coefficient - leafy vegetables
Cs-137	3.74E-11	0.04	0.04	0.04
Co-60	2.23E-11	0.08	0.08	0.08

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Soil-to-plant transfer coefficient - fruit	Soil-to-plant transfer coefficient - root vegetables	Soil-to-plant transfer coefficient - leafy vegetables	Intake Rate (pCi)	Cancer Slope Factor (pCi) ⁻¹	Increased Lifetime Cancer Risk
SU01	FR0100	1	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU02	FR0100	2	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU03	FR0100	3	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU04	FR0111	8	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU05	FR0111	9	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU06	FR0111	10	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU07	FR0111	11	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU08	FR0111	12	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU09	FR0111	13	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU10	FR0111	14	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU11	FR0111	15	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU12	FR0111	16	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU13	FR0111	17	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00

TABLE E-15
 Estimation of Total Dose and Risk from Crop Ingestion from Radionuclides, Onsite Resident Exposure Scenario, (FGR-13/HEAST Methodology)
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Soil-to-plant transfer coefficient - fruit	Soil-to-plant transfer coefficient - root vegetables	Soil-to-plant transfer coefficient - leafy vegetables	Intake Rate (pCi)	Cancer Slope Factor (pCi) ⁻¹	Increased Lifetime Cancer Risk
SU14	FR0111	18	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU15	FR0111	19	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU16	FR0111	20	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU17	FR0200	1	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU18	FR0200	2	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU19	FR0200	3	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU20	FR0200	4	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU21	FR0200	5	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU22	FR0200	6	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU23	FR0200	7	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU24	FR0200	8	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU25	FR0200	9	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU26	FR0400	1	Cs-137	1.24E-01	8.96E-02	4.00E-02	4.00E-02	4.00E-02	2.77E+03	3.74E-11	1.04E-07
SU27	FR0400	2	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU30	FR0500	1	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU31	FR0500	2	Cs-137	2.26E-01	1.63E-01	4.00E-02	4.00E-02	4.00E-02	5.06E+03	3.74E-11	1.89E-07
SU32	FR0800	1	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU33	FR0810	1	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU34	FR0900	1	Cs-137	1.30E-02	9.39E-03	4.00E-02	4.00E-02	4.00E-02	2.91E+02	3.74E-11	1.09E-08
SU35	FR0900	2	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU36	FR0900	3	Cs-137	1.67E-01	1.21E-01	4.00E-02	4.00E-02	4.00E-02	3.74E+03	3.74E-11	1.40E-07
SU37	FR0900	4	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU38	FR0910	1	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU39	FR1000	0	Cs-137	1.62E-01	1.17E-01	4.00E-02	4.00E-02	4.00E-02	3.62E+03	3.74E-11	1.36E-07
SU40	FR1800	1	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU41	FR1800	2	Cs-137	4.10E-02	2.96E-02	4.00E-02	4.00E-02	4.00E-02	9.17E+02	3.74E-11	3.43E-08
SU42	FR1800	3	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU43	FR2900	1	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU44	FR2900	2	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU45	FR2900	3	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU46	FB1400	1	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU47	FB1500	1	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU48	FB1700	1	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU49	FB1900	1	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU50	FB2000	1	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU51	FB2600	1	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU52	FA0400	1	Cs-137	0.00E+00	0.00E+00	4.00E-02	4.00E-02	4.00E-02	0.00E+00	3.74E-11	0.00E+00
SU01	FR0100	1	Co-60	0.00E+00	0.00E+00	8.00E-02	8.00E-02	8.00E-02	0.00E+00	2.23E-11	0.00E+00
SU02	FR0100	2	Co-60	5.08E-02	1.26E-02	8.00E-02	8.00E-02	8.00E-02	7.82E+02	2.23E-11	1.74E-08
SU03	FR0100	3	Co-60	0.00E+00	0.00E+00	8.00E-02	8.00E-02	8.00E-02	0.00E+00	2.23E-11	0.00E+00
SU04	FR0111	8	Co-60	0.00E+00	0.00E+00	8.00E-02	8.00E-02	8.00E-02	0.00E+00	2.23E-11	0.00E+00
SU05	FR0111	9	Co-60	5.78E-02	1.44E-02	8.00E-02	8.00E-02	8.00E-02	8.90E+02	2.23E-11	1.98E-08
SU06	FR0111	10	Co-60	7.18E-02	1.79E-02	8.00E-02	8.00E-02	8.00E-02	1.11E+03	2.23E-11	2.46E-08
SU07	FR0111	11	Co-60	6.54E-02	1.63E-02	8.00E-02	8.00E-02	8.00E-02	1.01E+03	2.23E-11	2.25E-08
SU08	FR0111	12	Co-60	6.05E-02	1.50E-02	8.00E-02	8.00E-02	8.00E-02	9.31E+02	2.23E-11	2.08E-08
SU09	FR0111	13	Co-60	0.00E+00	0.00E+00	8.00E-02	8.00E-02	8.00E-02	0.00E+00	2.23E-11	0.00E+00
SU10	FR0111	14	Co-60	5.23E-02	1.30E-02	8.00E-02	8.00E-02	8.00E-02	8.05E+02	2.23E-11	1.80E-08
SU11	FR0111	15	Co-60	5.99E-02	1.49E-02	8.00E-02	8.00E-02	8.00E-02	9.22E+02	2.23E-11	2.06E-08

TABLE E-15
 Estimation of Total Dose and Risk from Crop Ingestion from Radionuclides, Onsite Resident Exposure Scenario, (FGR-13/HEAST Methodology)
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Soil-to-plant transfer coefficient - fruit	Soil-to-plant transfer coefficient - root vegetables	Soil-to-plant transfer coefficient - leafy vegetables	Intake Rate (pCi)	Cancer Slope Factor (pCi) ⁻¹	Increased Lifetime Cancer Risk
SU12	FR0111	16	Co-60	7.92E-02	1.97E-02	8.00E-02	8.00E-02	8.00E-02	1.22E+03	2.23E-11	2.72E-08
SU13	FR0111	17	Co-60	5.48E-02	1.36E-02	8.00E-02	8.00E-02	8.00E-02	8.44E+02	2.23E-11	1.88E-08
SU14	FR0111	18	Co-60	0.00E+00	0.00E+00	8.00E-02	8.00E-02	8.00E-02	0.00E+00	2.23E-11	0.00E+00
SU15	FR0111	19	Co-60	0.00E+00	0.00E+00	8.00E-02	8.00E-02	8.00E-02	0.00E+00	2.23E-11	0.00E+00
SU16	FR0111	20	Co-60	8.66E-02	2.15E-02	8.00E-02	8.00E-02	8.00E-02	1.33E+03	2.23E-11	2.97E-08
SU17	FR0200	1	Co-60	0.00E+00	0.00E+00	8.00E-02	8.00E-02	8.00E-02	0.00E+00	2.23E-11	0.00E+00
SU18	FR0200	2	Co-60	0.00E+00	0.00E+00	8.00E-02	8.00E-02	8.00E-02	0.00E+00	2.23E-11	0.00E+00
SU19	FR0200	3	Co-60	0.00E+00	0.00E+00	8.00E-02	8.00E-02	8.00E-02	0.00E+00	2.23E-11	0.00E+00
SU20	FR0200	4	Co-60	5.43E-02	1.35E-02	8.00E-02	8.00E-02	8.00E-02	8.36E+02	2.23E-11	1.86E-08
SU21	FR0200	5	Co-60	6.39E-02	1.59E-02	8.00E-02	8.00E-02	8.00E-02	9.84E+02	2.23E-11	2.19E-08
SU22	FR0200	6	Co-60	5.93E-02	1.47E-02	8.00E-02	8.00E-02	8.00E-02	9.13E+02	2.23E-11	2.04E-08
SU23	FR0200	7	Co-60	6.76E-02	1.68E-02	8.00E-02	8.00E-02	8.00E-02	1.04E+03	2.23E-11	2.32E-08
SU24	FR0200	8	Co-60	5.49E-02	1.36E-02	8.00E-02	8.00E-02	8.00E-02	8.45E+02	2.23E-11	1.88E-08
SU25	FR0200	9	Co-60	7.76E-02	1.93E-02	8.00E-02	8.00E-02	8.00E-02	1.19E+03	2.23E-11	2.66E-08
SU26	FR0400	1	Co-60	5.45E-01	1.36E-01	8.00E-02	8.00E-02	8.00E-02	8.39E+03	2.23E-11	1.87E-07
SU27	FR0400	2	Co-60	7.34E-02	1.82E-02	8.00E-02	8.00E-02	8.00E-02	1.13E+03	2.23E-11	2.52E-08
SU30	FR0500	1	Co-60	0.00E+00	0.00E+00	8.00E-02	8.00E-02	8.00E-02	0.00E+00	2.23E-11	0.00E+00
SU31	FR0500	2	Co-60	0.00E+00	0.00E+00	8.00E-02	8.00E-02	8.00E-02	0.00E+00	2.23E-11	0.00E+00
SU32	FR0800	1	Co-60	7.79E-02	1.94E-02	8.00E-02	8.00E-02	8.00E-02	1.20E+03	2.23E-11	2.67E-08
SU33	FR0810	1	Co-60	0.00E+00	0.00E+00	8.00E-02	8.00E-02	8.00E-02	0.00E+00	2.23E-11	0.00E+00
SU34	FR0900	1	Co-60	0.00E+00	0.00E+00	8.00E-02	8.00E-02	8.00E-02	0.00E+00	2.23E-11	0.00E+00
SU35	FR0900	2	Co-60	0.00E+00	0.00E+00	8.00E-02	8.00E-02	8.00E-02	0.00E+00	2.23E-11	0.00E+00
SU36	FR0900	3	Co-60	0.00E+00	0.00E+00	8.00E-02	8.00E-02	8.00E-02	0.00E+00	2.23E-11	0.00E+00
SU37	FR0900	4	Co-60	6.54E-02	1.63E-02	8.00E-02	8.00E-02	8.00E-02	1.01E+03	2.23E-11	2.25E-08
SU38	FR0910	1	Co-60	7.72E-02	1.92E-02	8.00E-02	8.00E-02	8.00E-02	1.19E+03	2.23E-11	2.65E-08
SU39	FR1000	0	Co-60	2.69E-01	6.69E-02	8.00E-02	8.00E-02	8.00E-02	4.14E+03	2.23E-11	9.23E-08
SU40	FR1800	1	Co-60	0.00E+00	0.00E+00	8.00E-02	8.00E-02	8.00E-02	0.00E+00	2.23E-11	0.00E+00
SU41	FR1800	2	Co-60	0.00E+00	0.00E+00	8.00E-02	8.00E-02	8.00E-02	0.00E+00	2.23E-11	0.00E+00
SU42	FR1800	3	Co-60	0.00E+00	0.00E+00	8.00E-02	8.00E-02	8.00E-02	0.00E+00	2.23E-11	0.00E+00
SU43	FR2900	1	Co-60	0.00E+00	0.00E+00	8.00E-02	8.00E-02	8.00E-02	0.00E+00	2.23E-11	0.00E+00
SU44	FR2900	2	Co-60	4.20E-02	1.04E-02	8.00E-02	8.00E-02	8.00E-02	6.47E+02	2.23E-11	1.44E-08
SU45	FR2900	3	Co-60	0.00E+00	0.00E+00	8.00E-02	8.00E-02	8.00E-02	0.00E+00	2.23E-11	0.00E+00
SU46	FB1400	1	Co-60	0.00E+00	0.00E+00	8.00E-02	8.00E-02	8.00E-02	0.00E+00	2.23E-11	0.00E+00
SU47	FB1500	1	Co-60	0.00E+00	0.00E+00	8.00E-02	8.00E-02	8.00E-02	0.00E+00	2.23E-11	0.00E+00
SU48	FB1700	1	Co-60	0.00E+00	0.00E+00	8.00E-02	8.00E-02	8.00E-02	0.00E+00	2.23E-11	0.00E+00
SU49	FB1900	1	Co-60	0.00E+00	0.00E+00	8.00E-02	8.00E-02	8.00E-02	0.00E+00	2.23E-11	0.00E+00
SU50	FB2000	1	Co-60	0.00E+00	0.00E+00	8.00E-02	8.00E-02	8.00E-02	0.00E+00	2.23E-11	0.00E+00
SU51	FB2600	1	Co-60	0.00E+00	0.00E+00	8.00E-02	8.00E-02	8.00E-02	0.00E+00	2.23E-11	0.00E+00
SU52	FA0400	1	Co-60	1.33E-01	3.31E-02	8.00E-02	8.00E-02	8.00E-02	2.05E+03	2.23E-11	4.57E-08

TABLE E-16

Estimation of Total Dose and Risk from External Exposure from Radionuclides, Onsite Resident Exposure Scenario, (FGR13/HEAST Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

$$E = C \times \left(\frac{EF}{365} \right) \times ED \times ACF \times [ET_o + (ET_i \times GSF)]$$

$$ILCR = E \times CSF$$

Parameter	Units	Value	Description
E	pCi - s/g	Calculated	Exposure rate from soil
C	pCi/g	Input	Concentration in soil, averaged over exposure duration
EF	days/year	350	Exposure frequency
ED	years	30	Exposure duration
ACF	unitless	0.90	Area correction factor
ET _o	unitless	0.073	Exposure time outdoors
ET _i	unitless	0.683	Exposure time indoors
GSF	unitless	0.40	Indoor gamma shielding factor
ILCR	unitless	Calculated	Increased lifetime cancer risk

Radionuclide	Cancer Slope Factor (Risk/yr per pCi/g)
Cs-137	2.55E-06
Co-60	1.24E-05

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Cancer Slope Factor (Risk/yr per pCi/g)	Increased Lifetime Cancer Risk
SU01	FR0100	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU02	FR0100	2	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU03	FR0100	3	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU04	FR0111	8	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU05	FR0111	9	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU06	FR0111	10	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU07	FR0111	11	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU08	FR0111	12	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU09	FR0111	13	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU10	FR0111	14	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU11	FR0111	15	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU12	FR0111	16	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU13	FR0111	17	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00

TABLE E-16

Estimation of Total Dose and Risk from External Exposure from Radionuclides, Onsite Resident Exposure Scenario, (FGR13/HEAST Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Cancer Slope Factor (Risk/yr per pCi/g)	Increased Lifetime Cancer Risk
SU14	FR0111	18	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU15	FR0111	19	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU16	FR0111	20	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU17	FR0200	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU18	FR0200	2	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU19	FR0200	3	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU20	FR0200	4	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU21	FR0200	5	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU22	FR0200	6	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU23	FR0200	7	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU24	FR0200	8	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU25	FR0200	9	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU26	FR0400	1	Cs-137	1.24E-01	8.96E-02	2.55E-06	2.05E-06
SU27	FR0400	2	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU30	FR0500	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU31	FR0500	2	Cs-137	2.26E-01	1.63E-01	2.55E-06	3.73E-06
SU32	FR0800	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU33	FR0810	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU34	FR0900	1	Cs-137	1.30E-02	9.39E-03	2.55E-06	2.15E-07
SU35	FR0900	2	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU36	FR0900	3	Cs-137	1.67E-01	1.21E-01	2.55E-06	2.76E-06
SU37	FR0900	4	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU38	FR0910	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU39	FR1000	0	Cs-137	1.62E-01	1.17E-01	2.55E-06	2.68E-06
SU40	FR1800	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU41	FR1800	2	Cs-137	4.10E-02	2.96E-02	2.55E-06	6.77E-07
SU42	FR1800	3	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU43	FR2900	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU44	FR2900	2	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU45	FR2900	3	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU46	FB1400	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU47	FB1500	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU48	FB1700	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU49	FB1900	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU50	FB2000	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU51	FB2600	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU52	FA0400	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU01	FR0100	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU02	FR0100	2	Co-60	5.08E-02	1.26E-02	1.24E-05	1.40E-06
SU03	FR0100	3	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU04	FR0111	8	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU05	FR0111	9	Co-60	5.78E-02	1.44E-02	1.24E-05	1.60E-06
SU06	FR0111	10	Co-60	7.18E-02	1.79E-02	1.24E-05	1.98E-06

TABLE E-16

Estimation of Total Dose and Risk from External Exposure from Radionuclides, Onsite Resident Exposure Scenario, (FGR13/HEAST Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Cancer Slope Factor (Risk/yr per pCi/g)	Increased Lifetime Cancer Risk
SU07	FR0111	11	Co-60	6.54E-02	1.63E-02	1.24E-05	1.81E-06
SU08	FR0111	12	Co-60	6.05E-02	1.50E-02	1.24E-05	1.67E-06
SU09	FR0111	13	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU10	FR0111	14	Co-60	5.23E-02	1.30E-02	1.24E-05	1.45E-06
SU11	FR0111	15	Co-60	5.99E-02	1.49E-02	1.24E-05	1.66E-06
SU12	FR0111	16	Co-60	7.92E-02	1.97E-02	1.24E-05	2.19E-06
SU13	FR0111	17	Co-60	5.48E-02	1.36E-02	1.24E-05	1.51E-06
SU14	FR0111	18	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU15	FR0111	19	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU16	FR0111	20	Co-60	8.66E-02	2.15E-02	1.24E-05	2.39E-06
SU17	FR0200	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU18	FR0200	2	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU19	FR0200	3	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU20	FR0200	4	Co-60	5.43E-02	1.35E-02	1.24E-05	1.50E-06
SU21	FR0200	5	Co-60	6.39E-02	1.59E-02	1.24E-05	1.77E-06
SU22	FR0200	6	Co-60	5.93E-02	1.47E-02	1.24E-05	1.64E-06
SU23	FR0200	7	Co-60	6.76E-02	1.68E-02	1.24E-05	1.87E-06
SU24	FR0200	8	Co-60	5.49E-02	1.36E-02	1.24E-05	1.52E-06
SU25	FR0200	9	Co-60	7.76E-02	1.93E-02	1.24E-05	2.14E-06
SU26	FR0400	1	Co-60	5.45E-01	1.36E-01	1.24E-05	1.51E-05
SU27	FR0400	2	Co-60	7.34E-02	1.82E-02	1.24E-05	2.03E-06
SU30	FR0500	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU31	FR0500	2	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU32	FR0800	1	Co-60	7.79E-02	1.94E-02	1.24E-05	2.15E-06
SU33	FR0810	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU34	FR0900	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU35	FR0900	2	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU36	FR0900	3	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU37	FR0900	4	Co-60	6.54E-02	1.63E-02	1.24E-05	1.81E-06
SU38	FR0910	1	Co-60	7.72E-02	1.92E-02	1.24E-05	2.13E-06
SU39	FR1000	0	Co-60	2.69E-01	6.69E-02	1.24E-05	7.43E-06
SU40	FR1800	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU41	FR1800	2	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU42	FR1800	3	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU43	FR2900	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU44	FR2900	2	Co-60	4.20E-02	1.04E-02	1.24E-05	1.16E-06
SU45	FR2900	3	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU46	FB1400	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU47	FB1500	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU48	FB1700	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU49	FB1900	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU50	FB2000	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU51	FB2600	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU52	FA0400	1	Co-60	1.33E-01	3.31E-02	1.24E-05	3.68E-06

TABLE E-17

Estimation of Total Dose and Risk from Radionuclides, Onsite Worker Exposure Scenario, (FGR13/HEAST Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Excess Lifetime Cancer Risk			Total Radionuclide Excess Lifetime Cancer Risk
						Soil Ingestion	External Exposure	Total	
SU01	FR0100	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU02	FR0100	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.99E-07
SU03	FR0100	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU04	FR0111	8	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU05	FR0111	9	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.54E-07
SU06	FR0111	10	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.64E-07
SU07	FR0111	11	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.14E-07
SU08	FR0111	12	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.75E-07
SU09	FR0111	13	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU10	FR0111	14	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.11E-07
SU11	FR0111	15	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.71E-07
SU12	FR0111	16	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.22E-07
SU13	FR0111	17	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.30E-07
SU14	FR0111	18	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU15	FR0111	19	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU16	FR0111	20	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.80E-07
SU17	FR0200	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU18	FR0200	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU19	FR0200	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU20	FR0200	4	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.27E-07
SU21	FR0200	5	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.02E-07
SU22	FR0200	6	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.66E-07
SU23	FR0200	7	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.31E-07
SU24	FR0200	8	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.31E-07
SU25	FR0200	9	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.10E-07
SU26	FR0400	1	Cs-137	1.24E-01	9.43E-02	1.53E-09	5.20E-07	5.22E-07	4.80E-06
SU27	FR0400	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.77E-07
SU30	FR0500	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU31	FR0500	2	Cs-137	2.26E-01	1.72E-01	2.79E-09	9.48E-07	9.51E-07	9.51E-07
SU32	FR0800	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.12E-07
SU33	FR0810	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU34	FR0900	1	Cs-137	1.30E-02	9.89E-03	1.61E-10	5.45E-08	5.47E-08	5.47E-08
SU35	FR0900	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU36	FR0900	3	Cs-137	1.67E-01	1.27E-01	2.06E-09	7.00E-07	7.02E-07	7.02E-07
SU37	FR0900	4	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.14E-07
SU38	FR0910	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.06E-07
SU39	FR1000	0	Cs-137	1.62E-01	1.23E-01	2.00E-09	6.79E-07	6.81E-07	2.79E-06
SU40	FR1800	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU41	FR1800	2	Cs-137	4.10E-02	3.12E-02	5.06E-10	1.72E-07	1.72E-07	1.72E-07
SU42	FR1800	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU43	FR2900	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE E-17

Estimation of Total Dose and Risk from Radionuclides, Onsite Worker Exposure Scenario, (FGR13/HEAST Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Excess Lifetime Cancer Risk			Total Radionuclide Excess Lifetime Cancer Risk
						Soil Ingestion	External Exposure	Total	
SU44	FR2900	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.30E-07
SU45	FR2900	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU46	FB1400	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU47	FB1500	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU48	FB1700	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU49	FB1900	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU50	FB2000	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU51	FB2600	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU52	FA0400	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E-06
									4.80E-06 MAX
SU01	FR0100	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU02	FR0100	2	Co-60	5.08E-02	1.49E-02	2.25E-10	3.99E-07	3.99E-07	
SU03	FR0100	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU04	FR0111	8	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU05	FR0111	9	Co-60	5.78E-02	1.69E-02	2.56E-10	4.54E-07	4.54E-07	
SU06	FR0111	10	Co-60	7.18E-02	2.10E-02	3.18E-10	5.64E-07	5.64E-07	
SU07	FR0111	11	Co-60	6.54E-02	1.92E-02	2.89E-10	5.13E-07	5.14E-07	
SU08	FR0111	12	Co-60	6.05E-02	1.77E-02	2.68E-10	4.75E-07	4.75E-07	
SU09	FR0111	13	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU10	FR0111	14	Co-60	5.23E-02	1.53E-02	2.31E-10	4.11E-07	4.11E-07	
SU11	FR0111	15	Co-60	5.99E-02	1.75E-02	2.65E-10	4.70E-07	4.71E-07	
SU12	FR0111	16	Co-60	7.92E-02	2.32E-02	3.51E-10	6.22E-07	6.22E-07	
SU13	FR0111	17	Co-60	5.48E-02	1.60E-02	2.43E-10	4.30E-07	4.30E-07	
SU14	FR0111	18	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU15	FR0111	19	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU16	FR0111	20	Co-60	8.66E-02	2.54E-02	3.83E-10	6.80E-07	6.80E-07	
SU17	FR0200	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU18	FR0200	2	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU19	FR0200	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU20	FR0200	4	Co-60	5.43E-02	1.59E-02	2.40E-10	4.26E-07	4.27E-07	
SU21	FR0200	5	Co-60	6.39E-02	1.87E-02	2.83E-10	5.02E-07	5.02E-07	
SU22	FR0200	6	Co-60	5.93E-02	1.74E-02	2.62E-10	4.66E-07	4.66E-07	
SU23	FR0200	7	Co-60	6.76E-02	1.98E-02	2.99E-10	5.31E-07	5.31E-07	
SU24	FR0200	8	Co-60	5.49E-02	1.61E-02	2.43E-10	4.31E-07	4.31E-07	
SU25	FR0200	9	Co-60	7.76E-02	2.27E-02	3.43E-10	6.09E-07	6.10E-07	
SU26	FR0400	1	Co-60	5.45E-01	1.60E-01	2.41E-09	4.28E-06	4.28E-06	
SU27	FR0400	2	Co-60	7.34E-02	2.15E-02	3.25E-10	5.76E-07	5.77E-07	
SU30	FR0500	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU31	FR0500	2	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU32	FR0800	1	Co-60	7.79E-02	2.28E-02	3.45E-10	6.12E-07	6.12E-07	
SU33	FR0810	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	

TABLE E-17

Estimation of Total Dose and Risk from Radionuclides, Onsite Worker Exposure Scenario, (FGR13/HEAST Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Excess Lifetime Cancer Risk			Total Radionuclide Excess Lifetime Cancer Risk
						Soil Ingestion	External Exposure	Total	
SU34	FR0900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU35	FR0900	2	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU36	FR0900	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU37	FR0900	4	Co-60	6.54E-02	1.92E-02	2.89E-10	5.13E-07	5.14E-07	
SU38	FR0910	1	Co-60	7.72E-02	2.26E-02	3.42E-10	6.06E-07	6.06E-07	
SU39	FR1000	0	Co-60	2.69E-01	7.88E-02	1.19E-09	2.11E-06	2.11E-06	
SU40	FR1800	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU41	FR1800	2	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU42	FR1800	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU43	FR2900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU44	FR2900	2	Co-60	4.20E-02	1.23E-02	1.86E-10	3.30E-07	3.30E-07	
SU45	FR2900	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU46	FB1400	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU47	FB1500	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU48	FB1700	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU49	FB1900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU50	FB2000	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU51	FB2600	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU52	FA0400	1	Co-60	1.33E-01	3.90E-02	5.89E-10	1.04E-06	1.04E-06	

TABLE E-18

Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Onsite Worker Exposure Scenario, (FGR13/HEAST Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

$$Intake_{si} = C_e \times IR_{si} \times 0.001 \times EF \times ED$$

$$ILCR = Intake_{si} \times CSF$$

Parameter	Units	Value	Description
Intake _{si}	pCi	Calculated	Radionuclide exposure through soil ingestion
C _e	pCi/g	Nuclide-specific	Exposure concentration in soil
IR _{si}	mg/day	100	Soil ingestion rate (0.001 g/mg is a conversion factor)
EF	days/year	150	Exposure frequency
ED	years	25	Exposure duration
CSF	pCi ⁻¹	Nuclide-specific	Cancer slope factor
ILCR	unitless	Calculated	Increased lifetime cancer risk

Radionuclide	Cancer Slope Factor (pCi) ⁻¹
Cs-137	4.33E-11
Co-60	4.03E-11

TABLE E-18

Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Onsite Worker Exposure Scenario, (FGR13/HEAST Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Intake (pCi)	Cancer Slope Factor (pCi) ⁻¹	Increased Lifetime Cancer Risk
SU01	FR0100	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU02	FR0100	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU03	FR0100	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU04	FR0111	8	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU05	FR0111	9	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU06	FR0111	10	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU07	FR0111	11	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU08	FR0111	12	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU09	FR0111	13	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU10	FR0111	14	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU11	FR0111	15	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU12	FR0111	16	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU13	FR0111	17	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU14	FR0111	18	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU15	FR0111	19	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU16	FR0111	20	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU17	FR0200	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU18	FR0200	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU19	FR0200	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU20	FR0200	4	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU21	FR0200	5	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU22	FR0200	6	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU23	FR0200	7	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU24	FR0200	8	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU25	FR0200	9	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU26	FR0400	1	Cs-137	1.24E-01	9.43E-02	3.54E+01	4.33E-11	1.53E-09
SU27	FR0400	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU30	FR0500	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU31	FR0500	2	Cs-137	2.26E-01	1.72E-01	6.45E+01	4.33E-11	2.79E-09
SU32	FR0800	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU33	FR0810	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU34	FR0900	1	Cs-137	1.30E-02	9.89E-03	3.71E+00	4.33E-11	1.61E-10
SU35	FR0900	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU36	FR0900	3	Cs-137	1.67E-01	1.27E-01	4.76E+01	4.33E-11	2.06E-09
SU37	FR0900	4	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU38	FR0910	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU39	FR1000	0	Cs-137	1.62E-01	1.23E-01	4.62E+01	4.33E-11	2.00E-09
SU40	FR1800	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU41	FR1800	2	Cs-137	4.10E-02	3.12E-02	1.17E+01	4.33E-11	5.06E-10
SU42	FR1800	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU43	FR2900	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU44	FR2900	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU45	FR2900	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00

TABLE E-18

Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Onsite Worker Exposure Scenario, (FGR13/HEAST Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Intake (pCi)	Cancer Slope Factor (pCi) ⁻¹	Increased Lifetime Cancer Risk
SU46	FB1400	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU47	FB1500	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU48	FB1700	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU49	FB1900	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU50	FB2000	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU51	FB2600	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU52	FA0400	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU01	FR0100	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU02	FR0100	2	Co-60	5.08E-02	1.49E-02	5.58E+00	4.03E-11	2.25E-10
SU03	FR0100	3	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU04	FR0111	8	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU05	FR0111	9	Co-60	5.78E-02	1.69E-02	6.35E+00	4.03E-11	2.56E-10
SU06	FR0111	10	Co-60	7.18E-02	2.10E-02	7.89E+00	4.03E-11	3.18E-10
SU07	FR0111	11	Co-60	6.54E-02	1.92E-02	7.18E+00	4.03E-11	2.89E-10
SU08	FR0111	12	Co-60	6.05E-02	1.77E-02	6.64E+00	4.03E-11	2.68E-10
SU09	FR0111	13	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU10	FR0111	14	Co-60	5.23E-02	1.53E-02	5.74E+00	4.03E-11	2.31E-10
SU11	FR0111	15	Co-60	5.99E-02	1.75E-02	6.58E+00	4.03E-11	2.65E-10
SU12	FR0111	16	Co-60	7.92E-02	2.32E-02	8.70E+00	4.03E-11	3.51E-10
SU13	FR0111	17	Co-60	5.48E-02	1.60E-02	6.02E+00	4.03E-11	2.43E-10
SU14	FR0111	18	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU15	FR0111	19	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU16	FR0111	20	Co-60	8.66E-02	2.54E-02	9.51E+00	4.03E-11	3.83E-10
SU17	FR0200	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU18	FR0200	2	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU19	FR0200	3	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU20	FR0200	4	Co-60	5.43E-02	1.59E-02	5.96E+00	4.03E-11	2.40E-10
SU21	FR0200	5	Co-60	6.39E-02	1.87E-02	7.02E+00	4.03E-11	2.83E-10
SU22	FR0200	6	Co-60	5.93E-02	1.74E-02	6.51E+00	4.03E-11	2.62E-10
SU23	FR0200	7	Co-60	6.76E-02	1.98E-02	7.42E+00	4.03E-11	2.99E-10
SU24	FR0200	8	Co-60	5.49E-02	1.61E-02	6.03E+00	4.03E-11	2.43E-10
SU25	FR0200	9	Co-60	7.76E-02	2.27E-02	8.52E+00	4.03E-11	3.43E-10
SU26	FR0400	1	Co-60	5.45E-01	1.60E-01	5.99E+01	4.03E-11	2.41E-09
SU27	FR0400	2	Co-60	7.34E-02	2.15E-02	8.06E+00	4.03E-11	3.25E-10
SU30	FR0500	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU31	FR0500	2	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU32	FR0800	1	Co-60	7.79E-02	2.28E-02	8.56E+00	4.03E-11	3.45E-10
SU33	FR0810	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU34	FR0900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU35	FR0900	2	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU36	FR0900	3	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU37	FR0900	4	Co-60	6.54E-02	1.92E-02	7.18E+00	4.03E-11	2.89E-10

TABLE E-18

Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Onsite Worker Exposure Scenario, (FGR13/HEAST Methodology)

*Cumulative Risk Assessment**Maine Yankee Facility, Wiscasset, ME*

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Intake (pCi)	Cancer Slope Factor (pCi) ⁻¹	Increased Lifetime Cancer Risk
SU38	FR0910	1	Co-60	7.72E-02	2.26E-02	8.48E+00	4.03E-11	3.42E-10
SU39	FR1000	0	Co-60	2.69E-01	7.88E-02	2.95E+01	4.03E-11	1.19E-09
SU40	FR1800	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU41	FR1800	2	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU42	FR1800	3	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU43	FR2900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU44	FR2900	2	Co-60	4.20E-02	1.23E-02	4.61E+00	4.03E-11	1.86E-10
SU45	FR2900	3	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU46	FB1400	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU47	FB1500	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU48	FB1700	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU49	FB1900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU50	FB2000	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU51	FB2600	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU52	FA0400	1	Co-60	1.33E-01	3.90E-02	1.46E+01	4.03E-11	5.89E-10

TABLE E-19

Estimation of Total Dose and Risk from External Exposure from Radionuclides, Onsite Worker Exposure Scenario, (FGR13/HEAST Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

$$E = C \times \left(\frac{EF}{365} \right) \times ED \times ACF \times [ET_o + (ET_i \times GSF)]$$

$$ILCR = E \times CSF$$

Parameter	Units	Value	Description
E	pCi - s/g	Calculated	Exposure rate from soil
C	pCi/g	Input	Concentration in soil, averaged over exposure duration
EF	days/year	150	Exposure frequency
ED	years	25	Exposure duration
ACF	unitless	0.90	Area correction factor
ET _o	unitless	0.167	Exposure time outdoors
ET _i	unitless	0.167	Exposure time indoors
GSF	unitless	0.40	Indoor gamma shielding factor
ILCR	unitless	Calculated	Increased lifetime cancer risk

Notes:

ET_o value assumes an 8 hour work day, where half of the time is spent outdoors. (8/24)0.5=0.167

ET_i value assumes an 8 hour work day, where half of the time is spent indoors. (8/24)0.5=0.167

Radionuclide	Cancer Slope Factor (pCi) ⁻¹
Cs-137	2.55E-06
Co-60	1.24E-05

TABLE E-19

Estimation of Total Dose and Risk from External Exposure from Radionuclides, Onsite Worker Exposure Scenario, (FGR13/HEAST Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Cancer Slope Factor (pCi) ⁻¹	Increased Lifetime Cancer Risk
SU01	FR0100	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU02	FR0100	2	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU03	FR0100	3	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU04	FR0111	8	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU05	FR0111	9	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU06	FR0111	10	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU07	FR0111	11	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU08	FR0111	12	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU09	FR0111	13	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU10	FR0111	14	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU11	FR0111	15	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU12	FR0111	16	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU13	FR0111	17	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU14	FR0111	18	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU15	FR0111	19	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU16	FR0111	20	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU17	FR0200	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU18	FR0200	2	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU19	FR0200	3	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU20	FR0200	4	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU21	FR0200	5	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU22	FR0200	6	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU23	FR0200	7	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU24	FR0200	8	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU25	FR0200	9	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU26	FR0400	1	Cs-137	1.24E-01	9.43E-02	2.55E-06	5.20E-07
SU27	FR0400	2	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU30	FR0500	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU31	FR0500	2	Cs-137	2.26E-01	1.72E-01	2.55E-06	9.48E-07
SU32	FR0800	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU33	FR0810	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU34	FR0900	1	Cs-137	1.30E-02	9.89E-03	2.55E-06	5.45E-08
SU35	FR0900	2	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU36	FR0900	3	Cs-137	1.67E-01	1.27E-01	2.55E-06	7.00E-07
SU37	FR0900	4	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU38	FR0910	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU39	FR1000	0	Cs-137	1.62E-01	1.23E-01	2.55E-06	6.79E-07
SU40	FR1800	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU41	FR1800	2	Cs-137	4.10E-02	3.12E-02	2.55E-06	1.72E-07
SU42	FR1800	3	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU43	FR2900	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU44	FR2900	2	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU45	FR2900	3	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU46	FB1400	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00

TABLE E-19

Estimation of Total Dose and Risk from External Exposure from Radionuclides, Onsite Worker Exposure Scenario, (FGR13/HEAST Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Cancer Slope Factor (pCi) ⁻¹	Increased Lifetime Cancer Risk
SU47	FB1500	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU48	FB1700	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU49	FB1900	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU50	FB2000	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU51	FB2600	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU52	FA0400	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU01	FR0100	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU02	FR0100	2	Co-60	5.08E-02	1.49E-02	1.24E-05	3.99E-07
SU03	FR0100	3	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU04	FR0111	8	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU05	FR0111	9	Co-60	5.78E-02	1.69E-02	1.24E-05	4.54E-07
SU06	FR0111	10	Co-60	7.18E-02	2.10E-02	1.24E-05	5.64E-07
SU07	FR0111	11	Co-60	6.54E-02	1.92E-02	1.24E-05	5.13E-07
SU08	FR0111	12	Co-60	6.05E-02	1.77E-02	1.24E-05	4.75E-07
SU09	FR0111	13	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU10	FR0111	14	Co-60	5.23E-02	1.53E-02	1.24E-05	4.11E-07
SU11	FR0111	15	Co-60	5.99E-02	1.75E-02	1.24E-05	4.70E-07
SU12	FR0111	16	Co-60	7.92E-02	2.32E-02	1.24E-05	6.22E-07
SU13	FR0111	17	Co-60	5.48E-02	1.60E-02	1.24E-05	4.30E-07
SU14	FR0111	18	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU15	FR0111	19	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU16	FR0111	20	Co-60	8.66E-02	2.54E-02	1.24E-05	6.80E-07
SU17	FR0200	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU18	FR0200	2	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU19	FR0200	3	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU20	FR0200	4	Co-60	5.43E-02	1.59E-02	1.24E-05	4.26E-07
SU21	FR0200	5	Co-60	6.39E-02	1.87E-02	1.24E-05	5.02E-07
SU22	FR0200	6	Co-60	5.93E-02	1.74E-02	1.24E-05	4.66E-07
SU23	FR0200	7	Co-60	6.76E-02	1.98E-02	1.24E-05	5.31E-07
SU24	FR0200	8	Co-60	5.49E-02	1.61E-02	1.24E-05	4.31E-07
SU25	FR0200	9	Co-60	7.76E-02	2.27E-02	1.24E-05	6.09E-07
SU26	FR0400	1	Co-60	5.45E-01	1.60E-01	1.24E-05	4.28E-06
SU27	FR0400	2	Co-60	7.34E-02	2.15E-02	1.24E-05	5.76E-07
SU30	FR0500	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU31	FR0500	2	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU32	FR0800	1	Co-60	7.79E-02	2.28E-02	1.24E-05	6.12E-07
SU33	FR0810	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU34	FR0900	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU35	FR0900	2	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU36	FR0900	3	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU37	FR0900	4	Co-60	6.54E-02	1.92E-02	1.24E-05	5.13E-07
SU38	FR0910	1	Co-60	7.72E-02	2.26E-02	1.24E-05	6.06E-07
SU39	FR1000	0	Co-60	2.69E-01	7.88E-02	1.24E-05	2.11E-06

TABLE E-19

Estimation of Total Dose and Risk from External Exposure from Radionuclides, Onsite Worker Exposure Scenario, (FGR13/HEAST Methodology)

*Cumulative Risk Assessment**Maine Yankee Facility, Wiscasset, ME*

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Cancer Slope Factor (pCi) ⁻¹	Increased Lifetime Cancer Risk
SU40	FR1800	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU41	FR1800	2	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU42	FR1800	3	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU43	FR2900	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU44	FR2900	2	Co-60	4.20E-02	1.23E-02	1.24E-05	3.30E-07
SU45	FR2900	3	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU46	FB1400	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU47	FB1500	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU48	FB1700	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU49	FB1900	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU50	FB2000	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU51	FB2600	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU52	FA0400	1	Co-60	1.33E-01	3.90E-02	1.24E-05	1.04E-06

TABLE E-20

Estimation of Total Dose and Risk from Radionuclides, Construction Worker Exposure Scenario, (FGR13/HEAST Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Initial Concentration in Soil (pCi/g)	Exposure Concentration in Soil (pCi/g)	Excess Lifetime Cancer Risk			Total Radionuclide Excess Lifetime Cancer Risk
						Soil Ingestion	External Exposure	Total	
SU01	FR0100	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU02	FR0100	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.76E-08
SU03	FR0100	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU04	FR0111	8	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU05	FR0111	9	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.83E-08
SU06	FR0111	10	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.10E-07
SU07	FR0111	11	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-07
SU08	FR0111	12	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.25E-08
SU09	FR0111	13	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU10	FR0111	14	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.99E-08
SU11	FR0111	15	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.16E-08
SU12	FR0111	16	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.21E-07
SU13	FR0111	17	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.38E-08
SU14	FR0111	18	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU15	FR0111	19	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU16	FR0111	20	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.32E-07
SU17	FR0200	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU18	FR0200	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU19	FR0200	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU20	FR0200	4	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.30E-08
SU21	FR0200	5	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.77E-08
SU22	FR0200	6	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.06E-08
SU23	FR0200	7	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.03E-07
SU24	FR0200	8	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.39E-08
SU25	FR0200	9	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.19E-07
SU26	FR0400	1	Cs-137	1.24E-01	1.23E-01	2.80E-10	4.11E-08	4.13E-08	8.74E-07
SU27	FR0400	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.12E-07
SU30	FR0500	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU31	FR0500	2	Cs-137	2.26E-01	2.23E-01	5.11E-10	7.48E-08	7.54E-08	7.54E-08
SU32	FR0800	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.19E-07
SU33	FR0810	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU34	FR0900	1	Cs-137	1.30E-02	1.29E-02	2.94E-11	4.31E-09	4.33E-09	4.33E-09
SU35	FR0900	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU36	FR0900	3	Cs-137	1.67E-01	1.65E-01	3.77E-10	5.53E-08	5.57E-08	5.57E-08
SU37	FR0900	4	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-07
SU38	FR0910	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.18E-07
SU39	FR1000	0	Cs-137	1.62E-01	1.60E-01	3.66E-10	5.37E-08	5.40E-08	4.65E-07
SU40	FR1800	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU41	FR1800	2	Cs-137	4.10E-02	4.05E-02	9.27E-11	1.36E-08	1.37E-08	1.37E-08
SU42	FR1800	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU43	FR2900	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU44	FR2900	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.42E-08

TABLE E-20

Estimation of Total Dose and Risk from Radionuclides, Construction Worker Exposure Scenario, (FGR13/HEAST Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Initial Concentration in Soil (pCi/g)	Exposure Concentration in Soil (pCi/g)	Excess Lifetime Cancer Risk			Total Radionuclide Excess Lifetime Cancer Risk
						Soil Ingestion	External Exposure	Total	
SU45	FR2900	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU46	FB1400	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU47	FB1500	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU48	FB1700	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU49	FB1900	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU50	FB2000	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU51	FB2600	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU52	FA0400	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.03E-07
									8.74E-07 MAX
SU01	FR0100	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU02	FR0100	2	Co-60	5.08E-02	4.76E-02	1.01E-10	7.75E-08	7.76E-08	
SU03	FR0100	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU04	FR0111	8	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU05	FR0111	9	Co-60	5.78E-02	5.42E-02	1.15E-10	8.82E-08	8.83E-08	
SU06	FR0111	10	Co-60	7.18E-02	6.73E-02	1.43E-10	1.10E-07	1.10E-07	
SU07	FR0111	11	Co-60	6.54E-02	6.13E-02	1.30E-10	9.98E-08	1.00E-07	
SU08	FR0111	12	Co-60	6.05E-02	5.67E-02	1.21E-10	9.24E-08	9.25E-08	
SU09	FR0111	13	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU10	FR0111	14	Co-60	5.23E-02	4.90E-02	1.04E-10	7.98E-08	7.99E-08	
SU11	FR0111	15	Co-60	5.99E-02	5.61E-02	1.19E-10	9.14E-08	9.16E-08	
SU12	FR0111	16	Co-60	7.92E-02	7.42E-02	1.58E-10	1.21E-07	1.21E-07	
SU13	FR0111	17	Co-60	5.48E-02	5.14E-02	1.09E-10	8.37E-08	8.38E-08	
SU14	FR0111	18	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU15	FR0111	19	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU16	FR0111	20	Co-60	8.66E-02	8.11E-02	1.73E-10	1.32E-07	1.32E-07	
SU17	FR0200	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU18	FR0200	2	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU19	FR0200	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU20	FR0200	4	Co-60	5.43E-02	5.09E-02	1.08E-10	8.29E-08	8.30E-08	
SU21	FR0200	5	Co-60	6.39E-02	5.99E-02	1.27E-10	9.75E-08	9.77E-08	
SU22	FR0200	6	Co-60	5.93E-02	5.56E-02	1.18E-10	9.05E-08	9.06E-08	
SU23	FR0200	7	Co-60	6.76E-02	6.33E-02	1.35E-10	1.03E-07	1.03E-07	
SU24	FR0200	8	Co-60	5.49E-02	5.14E-02	1.09E-10	8.38E-08	8.39E-08	
SU25	FR0200	9	Co-60	7.76E-02	7.27E-02	1.55E-10	1.18E-07	1.19E-07	
SU26	FR0400	1	Co-60	5.45E-01	5.11E-01	1.09E-09	8.32E-07	8.33E-07	
SU27	FR0400	2	Co-60	7.34E-02	6.88E-02	1.46E-10	1.12E-07	1.12E-07	
SU30	FR0500	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU31	FR0500	2	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU32	FR0800	1	Co-60	7.79E-02	7.30E-02	1.55E-10	1.19E-07	1.19E-07	
SU33	FR0810	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU34	FR0900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU35	FR0900	2	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	

TABLE E-20

Estimation of Total Dose and Risk from Radionuclides, Construction Worker Exposure Scenario, (FGR13/HEAST Methodology)

*Cumulative Risk Assessment**Maine Yankee Facility, Wiscasset, ME*

Survey Unit Designation	Survey Units	#	Radionuclide	Initial Concentration in Soil (pCi/g)	Exposure Concentration in Soil (pCi/g)	Excess Lifetime Cancer Risk			Total Radionuclide Excess Lifetime Cancer Risk
						Soil Ingestion	External Exposure	Total	
SU36	FR0900	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU37	FR0900	4	Co-60	6.54E-02	6.13E-02	1.30E-10	9.98E-08	1.00E-07	
SU38	FR0910	1	Co-60	7.72E-02	7.23E-02	1.54E-10	1.18E-07	1.18E-07	
SU39	FR1000	0	Co-60	2.69E-01	2.52E-01	5.36E-10	4.11E-07	4.11E-07	
SU40	FR1800	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU41	FR1800	2	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU42	FR1800	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU43	FR2900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU44	FR2900	2	Co-60	4.20E-02	3.94E-02	8.37E-11	6.41E-08	6.42E-08	
SU45	FR2900	3	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU46	FB1400	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU47	FB1500	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU48	FB1700	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU49	FB1900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU50	FB2000	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU51	FB2600	1	Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
SU52	FA0400	1	Co-60	1.33E-01	1.25E-01	2.65E-10	2.03E-07	2.03E-07	

TABLE E-21

Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Construction Worker Exposure Scenario, (FGR13/HEAST Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

$$Intake_{si} = C_e \times IR_{si} \times 0.001 \times EF \times ED$$

$$ILCR = Intake_{si} \times CSF$$

Parameter	Units	Value	Description
Intake _{si}	pCi	Calculated	Radionuclide exposure through soil ingestion
C _e	pCi/g	Nuclide-specific	Exposure concentration in soil
IR _{si}	mg/day	330	Soil ingestion rate (0.001 g/mg is a conversion factor)
EF	days/year	160	Exposure frequency
ED	years	1	Exposure duration
RCF _i	mrem/pCi	Nuclide-specific	Risk conversion factor for ingestion (from FGR 13)
ILCR	unitless	Calculated	Increased lifetime cancer risk

Radionuclide	Cancer Slope Factor (pCi) ⁻¹
Cs-137	4.33E-11
Co-60	4.03E-11

TABLE E-21

Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Construction Worker Exposure Scenario, (FGR13/HEAST Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Intake (pCi)	Cancer Slope Factor (pCi) ⁻¹	Increased Lifetime Cancer Risk
SU01	FR0100	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU02	FR0100	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU03	FR0100	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU04	FR0111	8	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU05	FR0111	9	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU06	FR0111	10	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU07	FR0111	11	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU08	FR0111	12	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU09	FR0111	13	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU10	FR0111	14	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU11	FR0111	15	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU12	FR0111	16	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU13	FR0111	17	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU14	FR0111	18	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU15	FR0111	19	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU16	FR0111	20	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU17	FR0200	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU18	FR0200	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU19	FR0200	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU20	FR0200	4	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU21	FR0200	5	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU22	FR0200	6	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU23	FR0200	7	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU24	FR0200	8	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU25	FR0200	9	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU26	FR0400	1	Cs-137	1.24E-01	1.23E-01	6.47E+00	4.33E-11	2.80E-10
SU27	FR0400	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU30	FR0500	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU31	FR0500	2	Cs-137	2.26E-01	2.23E-01	1.18E+01	4.33E-11	5.11E-10
SU32	FR0800	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU33	FR0810	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU34	FR0900	1	Cs-137	1.30E-02	1.29E-02	6.79E-01	4.33E-11	2.94E-11
SU35	FR0900	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU36	FR0900	3	Cs-137	1.67E-01	1.65E-01	8.72E+00	4.33E-11	3.77E-10
SU37	FR0900	4	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU38	FR0910	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU39	FR1000	0	Cs-137	1.62E-01	1.60E-01	8.46E+00	4.33E-11	3.66E-10
SU40	FR1800	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU41	FR1800	2	Cs-137	4.10E-02	4.05E-02	2.14E+00	4.33E-11	9.27E-11
SU42	FR1800	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU43	FR2900	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU44	FR2900	2	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU45	FR2900	3	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00

TABLE E-21

Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Construction Worker Exposure Scenario, (FGR13/HEAST Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Intake (pCi)	Cancer Slope Factor (pCi) ⁻¹	Increased Lifetime Cancer Risk
SU46	FB1400	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU47	FB1500	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU48	FB1700	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU49	FB1900	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU50	FB2000	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU51	FB2600	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU52	FA0400	1	Cs-137	0.00E+00	0.00E+00	0.00E+00	4.33E-11	0.00E+00
SU01	FR0100	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU02	FR0100	2	Co-60	5.08E-02	4.76E-02	2.51E+00	4.03E-11	1.01E-10
SU03	FR0100	3	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU04	FR0111	8	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU05	FR0111	9	Co-60	5.78E-02	5.42E-02	2.86E+00	4.03E-11	1.15E-10
SU06	FR0111	10	Co-60	7.18E-02	6.73E-02	3.55E+00	4.03E-11	1.43E-10
SU07	FR0111	11	Co-60	6.54E-02	6.13E-02	3.24E+00	4.03E-11	1.30E-10
SU08	FR0111	12	Co-60	6.05E-02	5.67E-02	2.99E+00	4.03E-11	1.21E-10
SU09	FR0111	13	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU10	FR0111	14	Co-60	5.23E-02	4.90E-02	2.59E+00	4.03E-11	1.04E-10
SU11	FR0111	15	Co-60	5.99E-02	5.61E-02	2.96E+00	4.03E-11	1.19E-10
SU12	FR0111	16	Co-60	7.92E-02	7.42E-02	3.92E+00	4.03E-11	1.58E-10
SU13	FR0111	17	Co-60	5.48E-02	5.14E-02	2.71E+00	4.03E-11	1.09E-10
SU14	FR0111	18	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU15	FR0111	19	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU16	FR0111	20	Co-60	8.66E-02	8.11E-02	4.28E+00	4.03E-11	1.73E-10
SU17	FR0200	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU18	FR0200	2	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU19	FR0200	3	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU20	FR0200	4	Co-60	5.43E-02	5.09E-02	2.69E+00	4.03E-11	1.08E-10
SU21	FR0200	5	Co-60	6.39E-02	5.99E-02	3.16E+00	4.03E-11	1.27E-10
SU22	FR0200	6	Co-60	5.93E-02	5.56E-02	2.93E+00	4.03E-11	1.18E-10
SU23	FR0200	7	Co-60	6.76E-02	6.33E-02	3.34E+00	4.03E-11	1.35E-10
SU24	FR0200	8	Co-60	5.49E-02	5.14E-02	2.72E+00	4.03E-11	1.09E-10
SU25	FR0200	9	Co-60	7.76E-02	7.27E-02	3.84E+00	4.03E-11	1.55E-10
SU26	FR0400	1	Co-60	5.45E-01	5.11E-01	2.70E+01	4.03E-11	1.09E-09
SU27	FR0400	2	Co-60	7.34E-02	6.88E-02	3.63E+00	4.03E-11	1.46E-10
SU30	FR0500	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU31	FR0500	2	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU32	FR0800	1	Co-60	7.79E-02	7.30E-02	3.85E+00	4.03E-11	1.55E-10
SU33	FR0810	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU34	FR0900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU35	FR0900	2	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU36	FR0900	3	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU37	FR0900	4	Co-60	6.54E-02	6.13E-02	3.24E+00	4.03E-11	1.30E-10

TABLE E-21

Estimation of Total Dose and Risk from Soil Ingestion from Radionuclides, Construction Worker Exposure Scenario, (FGR13/HEAST Methodology)

*Cumulative Risk Assessment**Maine Yankee Facility, Wiscasset, ME*

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Intake (pCi)	Cancer Slope Factor (pCi) ⁻¹	Increased Lifetime Cancer Risk
SU38	FR0910	1	Co-60	7.72E-02	7.23E-02	3.82E+00	4.03E-11	1.54E-10
SU39	FR1000	0	Co-60	2.69E-01	2.52E-01	1.33E+01	4.03E-11	5.36E-10
SU40	FR1800	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU41	FR1800	2	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU42	FR1800	3	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU43	FR2900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU44	FR2900	2	Co-60	4.20E-02	3.94E-02	2.08E+00	4.03E-11	8.37E-11
SU45	FR2900	3	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU46	FB1400	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU47	FB1500	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU48	FB1700	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU49	FB1900	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU50	FB2000	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU51	FB2600	1	Co-60	0.00E+00	0.00E+00	0.00E+00	4.03E-11	0.00E+00
SU52	FA0400	1	Co-60	1.33E-01	1.25E-01	6.58E+00	4.03E-11	2.65E-10

TABLE E-22

Estimation of Total Dose and Risk from External Exposure from Radionuclides, Construction Worker Exposure Scenario, (FGR13/HEAST Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

$$E = C \times \left(\frac{EF}{365} \right) \times ED \times 3.15E+07 \times ACF \times [ET_o + (ET_i \times GSF)]$$

$$ILCR = E \times CSF$$

Parameter	Units	Value	Description
E	pCi - s/m ³	Calculated	Exposure rate from soil
C	pCi/g	Input	Concentration in soil, averaged over exposure duration
EF	days/year	160	Exposure frequency
ED	years	1	Exposure duration
ACF	unitless	0.90	Area correction factor
ET _o	unitless	0.333	Exposure time outdoors
ET _i	unitless	0.000	Exposure time indoors
GSF	unitless	0.40	Indoor gamma shielding factor
CSF	Risk/year per pCi/g	Nuclide-specific	Cancer slope factor
ILCR	unitless	Calculated	Increased lifetime cancer risk
1.00E+00	y/year		Conversion factor

Notes:

ET_o value assumes an 8 hour work day, where 100% of the time is spent outdoors. (8/24)*100%=0.333

ET_i value assumes an 8 hour work day, where no hours are spent indoors.

Radionuclide	Cancer Slope Factor (Risk/year per pCi/g)
Cs-137	2.55E-06
Co-60	1.24E-05

TABLE E-22

Estimation of Total Dose and Risk from External Exposure from Radionuclides, Construction Worker Exposure Scenario, (FGR13/HEAST Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Cancer Slope Factor (Risk/year per pCi/g)	Increased Lifetime Cancer Risk
SU01	FR0100	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU02	FR0100	2	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU03	FR0100	3	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU04	FR0111	8	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU05	FR0111	9	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU06	FR0111	10	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU07	FR0111	11	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU08	FR0111	12	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU09	FR0111	13	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU10	FR0111	14	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU11	FR0111	15	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU12	FR0111	16	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU13	FR0111	17	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU14	FR0111	18	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU15	FR0111	19	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU16	FR0111	20	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU17	FR0200	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU18	FR0200	2	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU19	FR0200	3	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU20	FR0200	4	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU21	FR0200	5	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU22	FR0200	6	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU23	FR0200	7	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU24	FR0200	8	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU25	FR0200	9	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU26	FR0400	1	Cs-137	1.24E-01	1.23E-01	2.55E-06	4.11E-08
SU27	FR0400	2	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU30	FR0500	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU31	FR0500	2	Cs-137	2.26E-01	2.23E-01	2.55E-06	7.48E-08
SU32	FR0800	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU33	FR0810	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU34	FR0900	1	Cs-137	1.30E-02	1.29E-02	2.55E-06	4.31E-09
SU35	FR0900	2	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU36	FR0900	3	Cs-137	1.67E-01	1.65E-01	2.55E-06	5.53E-08
SU37	FR0900	4	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU38	FR0910	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU39	FR1000	0	Cs-137	1.62E-01	1.60E-01	2.55E-06	5.37E-08
SU40	FR1800	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU41	FR1800	2	Cs-137	4.10E-02	4.05E-02	2.55E-06	1.36E-08
SU42	FR1800	3	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU43	FR2900	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU44	FR2900	2	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU45	FR2900	3	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU46	FB1400	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00

TABLE E-22

Estimation of Total Dose and Risk from External Exposure from Radionuclides, Construction Worker Exposure Scenario, (FGR13/HEAST Methodology)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Cancer Slope Factor (Risk/year per pCi/g)	Increased Lifetime Cancer Risk
SU47	FB1500	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU48	FB1700	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU49	FB1900	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU50	FB2000	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU51	FB2600	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU52	FA0400	1	Cs-137	0.00E+00	0.00E+00	2.55E-06	0.00E+00
SU01	FR0100	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU02	FR0100	2	Co-60	5.08E-02	4.76E-02	1.24E-05	7.75E-08
SU03	FR0100	3	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU04	FR0111	8	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU05	FR0111	9	Co-60	5.78E-02	5.42E-02	1.24E-05	8.82E-08
SU06	FR0111	10	Co-60	7.18E-02	6.73E-02	1.24E-05	1.10E-07
SU07	FR0111	11	Co-60	6.54E-02	6.13E-02	1.24E-05	9.98E-08
SU08	FR0111	12	Co-60	6.05E-02	5.67E-02	1.24E-05	9.24E-08
SU09	FR0111	13	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU10	FR0111	14	Co-60	5.23E-02	4.90E-02	1.24E-05	7.98E-08
SU11	FR0111	15	Co-60	5.99E-02	5.61E-02	1.24E-05	9.14E-08
SU12	FR0111	16	Co-60	7.92E-02	7.42E-02	1.24E-05	1.21E-07
SU13	FR0111	17	Co-60	5.48E-02	5.14E-02	1.24E-05	8.37E-08
SU14	FR0111	18	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU15	FR0111	19	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU16	FR0111	20	Co-60	8.66E-02	8.11E-02	1.24E-05	1.32E-07
SU17	FR0200	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU18	FR0200	2	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU19	FR0200	3	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU20	FR0200	4	Co-60	5.43E-02	5.09E-02	1.24E-05	8.29E-08
SU21	FR0200	5	Co-60	6.39E-02	5.99E-02	1.24E-05	9.75E-08
SU22	FR0200	6	Co-60	5.93E-02	5.56E-02	1.24E-05	9.05E-08
SU23	FR0200	7	Co-60	6.76E-02	6.33E-02	1.24E-05	1.03E-07
SU24	FR0200	8	Co-60	5.49E-02	5.14E-02	1.24E-05	8.38E-08
SU25	FR0200	9	Co-60	7.76E-02	7.27E-02	1.24E-05	1.18E-07
SU26	FR0400	1	Co-60	5.45E-01	5.11E-01	1.24E-05	8.32E-07
SU27	FR0400	2	Co-60	7.34E-02	6.88E-02	1.24E-05	1.12E-07
SU30	FR0500	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU31	FR0500	2	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU32	FR0800	1	Co-60	7.79E-02	7.30E-02	1.24E-05	1.19E-07
SU33	FR0810	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU34	FR0900	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU35	FR0900	2	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU36	FR0900	3	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU37	FR0900	4	Co-60	6.54E-02	6.13E-02	1.24E-05	9.98E-08
SU38	FR0910	1	Co-60	7.72E-02	7.23E-02	1.24E-05	1.18E-07
SU39	FR1000	0	Co-60	2.69E-01	2.52E-01	1.24E-05	4.11E-07

TABLE E-22

Estimation of Total Dose and Risk from External Exposure from Radionuclides, Construction Worker Exposure Scenario, (FGR13/HEAST Methodology)

*Cumulative Risk Assessment**Maine Yankee Facility, Wiscasset, ME*

Survey Unit Designation	Survey Units	#	Radionuclide	Concentration Corrected for Background (pCi/g)	Exposure Concentration in Soil (pCi/g)	Cancer Slope Factor (Risk/year per pCi/g)	Increased Lifetime Cancer Risk
SU40	FR1800	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU41	FR1800	2	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU42	FR1800	3	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU43	FR2900	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU44	FR2900	2	Co-60	4.20E-02	3.94E-02	1.24E-05	6.41E-08
SU45	FR2900	3	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU46	FB1400	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU47	FB1500	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU48	FB1700	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU49	FB1900	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU50	FB2000	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU51	FB2600	1	Co-60	0.00E+00	0.00E+00	1.24E-05	0.00E+00
SU52	FA0400	1	Co-60	1.33E-01	1.25E-01	1.24E-05	2.03E-07

TABLE E-23

Excess Lifetime Cancer Risk (Radiological), All Scenarios - Comparison Between FGR 11/12 and FGR 13/HEAST Methodologies

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Area	Survey Unit	Survey Description	FGR-11/12			FGR-13/HEAST		
				On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker
SU01	FR0100	1	Yard West (2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU02	FR0100	2	Yard West (2)	1.53E-06	4.17E-07	8.10E-08	1.42E-06	3.99E-07	7.76E-08
SU03	FR0100	3	Yard West	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU04	FR0111	8	Soil Remediation Areas	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU05	FR0111	9	Soil Remediation Areas	1.75E-06	4.74E-07	9.22E-08	1.62E-06	4.54E-07	8.83E-08
SU06	FR0111	10	Soil Remediation Areas	2.17E-06	5.89E-07	1.15E-07	2.01E-06	5.64E-07	1.10E-07
SU07	FR0111	11	Soil Remediation Areas	1.97E-06	5.36E-07	1.04E-07	1.83E-06	5.14E-07	1.00E-07
SU08	FR0111	12	Soil Remediation Areas	1.83E-06	4.96E-07	9.65E-08	1.69E-06	4.75E-07	9.25E-08
SU09	FR0111	13	Soil Remediation Areas	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU10	FR0111	14	Soil Remediation Areas	1.58E-06	4.29E-07	8.34E-08	1.46E-06	4.11E-07	7.99E-08
SU11	FR0111	15	Soil Remediation Areas	1.81E-06	4.91E-07	9.56E-08	1.68E-06	4.71E-07	9.16E-08
SU12	FR0111	16	Soil Remediation Areas	2.39E-06	6.50E-07	1.26E-07	2.22E-06	6.22E-07	1.21E-07
SU13	FR0111	17	Soil Remediation Areas	1.65E-06	4.49E-07	8.74E-08	1.53E-06	4.30E-07	8.38E-08
SU14	FR0111	18	Soil Remediation Areas	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU15	FR0111	19	Soil Remediation Areas	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU16	FR0111	20	Soil Remediation Areas	2.61E-06	7.10E-07	1.38E-07	2.42E-06	6.80E-07	1.32E-07
SU17	FR0200	1	Yard East	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU18	FR0200	2	Yard East	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU19	FR0200	3	Yard East	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU20	FR0200	4	Yard East	1.64E-06	4.45E-07	8.66E-08	1.52E-06	4.27E-07	8.30E-08
SU21	FR0200	5	Yard East	1.93E-06	5.24E-07	1.02E-07	1.79E-06	5.02E-07	9.77E-08
SU22	FR0200	6	Yard East	1.79E-06	4.86E-07	9.46E-08	1.66E-06	4.66E-07	9.06E-08
SU23	FR0200	7	Yard East	2.04E-06	5.54E-07	1.08E-07	1.89E-06	5.31E-07	1.03E-07
SU24	FR0200	8	Yard East	1.66E-06	4.50E-07	8.76E-08	1.54E-06	4.31E-07	8.39E-08
SU25	FR0200	9	Yard East	2.34E-06	6.36E-07	1.24E-07	2.17E-06	6.10E-07	1.19E-07
SU26	FR0400	1	Forebay Seal Pit Floor	1.89E-05	5.06E-06	9.16E-07	1.74E-05	4.80E-06	8.74E-07
SU27	FR0400	2	Forebay Seal Pit Slopes	2.22E-06	6.02E-07	1.17E-07	2.05E-06	5.77E-07	1.12E-07
SU30	FR0500	1	Bailey Point	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU31	FR0500	2	Bailey Point	4.50E-06	1.07E-06	8.50E-08	3.93E-06	9.51E-07	7.54E-08
SU32	FR0800	1	Admin and Parking Areas	2.35E-06	6.39E-07	1.24E-07	2.18E-06	6.12E-07	1.19E-07
SU33	FR0810	1	Collection Site Sub Slab	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU34	FR0900	1	BOP Land (Land South of 345 Yard & Little Oak Is)	2.59E-07	6.17E-08	4.89E-09	2.26E-07	5.47E-08	4.33E-09
SU35	FR0900	2	BOP Land	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU36	FR0900	3	BOP Land	3.32E-06	7.93E-07	6.28E-08	2.90E-06	7.02E-07	5.57E-08
SU37	FR0900	4	BOP Land	1.97E-06	5.36E-07	1.04E-07	1.83E-06	5.14E-07	1.00E-07
SU38	FR0910	1	Fire Pond	2.33E-06	6.33E-07	1.23E-07	2.16E-06	6.06E-07	1.18E-07
SU39	FR1000	0	Foxbird Island	1.13E-05	2.98E-06	4.90E-07	1.03E-05	2.79E-06	4.65E-07
SU40	FR1800	1	Bailey Land	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU41	FR1800	2	Bailey Land	8.16E-07	1.95E-07	1.54E-08	7.12E-07	1.72E-07	1.37E-08
SU42	FR1800	3	Bailey Land	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU43	FR2900	1	Final Grade, Rails, Roads: East Plant Access Road & adjoining parking lots and roads	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE E-23

Excess Lifetime Cancer Risk (Radiological), All Scenarios - Comparison Between FGR 11/12 and FGR 13/HEAST Methodologies

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Area	Survey Unit	Survey Description	FGR-11/12			FGR-13/HEAST		
				On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker
SU44	FR2900	2	Final Grade, Rails, Roads: West Access Rd & adjoining parking lots and roads	1.27E-06	3.44E-07	6.70E-08	1.18E-06	3.30E-07	6.42E-08
SU45	FR2900	3	Final Grade, Rails, Roads (south & west) & Staff Bld Parking Lot, Lots E,C	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU46	FB1400	1	Information Center	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU47	FB1500	1	Warehouse 2/3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU48	FB1700	1	Staff Building	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU49	FB1900	1	Bailey House Footprint	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU50	FB2000	1	Bailey Barn Footprint	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU51	FB2600	1	Warehouse 5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU52	FA0400	1	Fuel Building Footprint	4.02E-06	1.09E-06	2.12E-07	3.72E-06	1.04E-06	2.03E-07
Maximum Case				1.89E-05	5.06E-06	9.16E-07	1.74E-05	4.80E-06	8.74E-07

TABLE E-24
Radionuclide Exposure Point Concentrations
Cumulative Risk Assessment
Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Area	Survey Unit	Survey Description	Source Concentration		Exposure Concentration (On-Site Resident)		Exposure Concentration (Worker)		Exposure Concentration (Construction Worker)	
				Cs-137 (pCi/g)	Co-60 (pCi/g)	Cs-137 (pCi/g)	Co-60 (pCi/g)	Cs-137 (pCi/g)	Co-60 (pCi/g)	Cs-137 (pCi/g)	Co-60 (pCi/g)
SU01	FR0100	1	Yard West (2)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU02	FR0100	2	Yard West (2)	0.00E+00	5.08E-02	0.00E+00	1.26E-02	0.00E+00	1.49E-02	0.00E+00	4.76E-02
SU03	FR0100	3	Yard West	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU04	FR0111	8	Soil Remediation Areas	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU05	FR0111	9	Soil Remediation Areas	0.00E+00	5.78E-02	0.00E+00	1.44E-02	0.00E+00	1.69E-02	0.00E+00	5.42E-02
SU06	FR0111	10	Soil Remediation Areas	0.00E+00	7.18E-02	0.00E+00	1.79E-02	0.00E+00	2.10E-02	0.00E+00	6.73E-02
SU07	FR0111	11	Soil Remediation Areas	0.00E+00	6.54E-02	0.00E+00	1.63E-02	0.00E+00	1.92E-02	0.00E+00	6.13E-02
SU08	FR0111	12	Soil Remediation Areas	0.00E+00	6.05E-02	0.00E+00	1.50E-02	0.00E+00	1.77E-02	0.00E+00	5.67E-02
SU09	FR0111	13	Soil Remediation Areas	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU10	FR0111	14	Soil Remediation Areas	0.00E+00	5.23E-02	0.00E+00	1.30E-02	0.00E+00	1.53E-02	0.00E+00	4.90E-02
SU11	FR0111	15	Soil Remediation Areas	0.00E+00	5.99E-02	0.00E+00	1.49E-02	0.00E+00	1.75E-02	0.00E+00	5.61E-02
SU12	FR0111	16	Soil Remediation Areas	0.00E+00	7.92E-02	0.00E+00	1.97E-02	0.00E+00	2.32E-02	0.00E+00	7.42E-02
SU13	FR0111	17	Soil Remediation Areas	0.00E+00	5.48E-02	0.00E+00	1.36E-02	0.00E+00	1.60E-02	0.00E+00	5.14E-02
SU14	FR0111	18	Soil Remediation Areas	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU15	FR0111	19	Soil Remediation Areas	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU16	FR0111	20	Soil Remediation Areas	0.00E+00	8.66E-02	0.00E+00	2.15E-02	0.00E+00	2.54E-02	0.00E+00	8.11E-02
SU17	FR0200	1	Yard East	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU18	FR0200	2	Yard East	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU19	FR0200	3	Yard East	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU20	FR0200	4	Yard East	0.00E+00	5.43E-02	0.00E+00	1.35E-02	0.00E+00	1.59E-02	0.00E+00	5.09E-02
SU21	FR0200	5	Yard East	0.00E+00	6.39E-02	0.00E+00	1.59E-02	0.00E+00	1.87E-02	0.00E+00	5.99E-02
SU22	FR0200	6	Yard East	0.00E+00	5.93E-02	0.00E+00	1.47E-02	0.00E+00	1.74E-02	0.00E+00	5.56E-02
SU23	FR0200	7	Yard East	0.00E+00	6.76E-02	0.00E+00	1.68E-02	0.00E+00	1.98E-02	0.00E+00	6.33E-02
SU24	FR0200	8	Yard East	0.00E+00	5.49E-02	0.00E+00	1.36E-02	0.00E+00	1.61E-02	0.00E+00	5.14E-02
SU25	FR0200	9	Yard East	0.00E+00	7.76E-02	0.00E+00	1.93E-02	0.00E+00	2.27E-02	0.00E+00	7.27E-02
SU26	FR0400	1	Forebay Seal Pit Floor	1.24E-01	5.45E-01	8.96E-02	1.36E-01	9.43E-02	1.60E-01	1.23E-01	5.11E-01
SU27	FR0400	2	Forebay Seal Pit Slopes	0.00E+00	7.34E-02	0.00E+00	1.82E-02	0.00E+00	2.15E-02	0.00E+00	6.88E-02
SU30	FR0500	1	Bailey Point	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU31	FR0500	2	Bailey Point	2.26E-01	0.00E+00	1.63E-01	0.00E+00	1.72E-01	0.00E+00	2.23E-01	0.00E+00
SU32	FR0800	1	Admin and Parking Areas	0.00E+00	7.79E-02	0.00E+00	1.94E-02	0.00E+00	2.28E-02	0.00E+00	7.30E-02
SU33	FR0810	1	Collection Site Sub Slab	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU34	FR0900	1	BOP Land (Land South of 345 Yard & Little Oak Is)	1.30E-02	0.00E+00	9.39E-03	0.00E+00	9.89E-03	0.00E+00	1.29E-02	0.00E+00
SU35	FR0900	2	BOP Land	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU36	FR0900	3	BOP Land	1.67E-01	0.00E+00	1.21E-01	0.00E+00	1.27E-01	0.00E+00	1.65E-01	0.00E+00
SU37	FR0900	4	BOP Land	0.00E+00	6.54E-02	0.00E+00	1.63E-02	0.00E+00	1.92E-02	0.00E+00	6.13E-02
SU38	FR0910	1	Fire Pond	0.00E+00	7.72E-02	0.00E+00	1.92E-02	0.00E+00	2.26E-02	0.00E+00	7.23E-02
SU39	FR1000	0	Foxbird Island	1.62E-01	2.69E-01	1.17E-01	6.69E-02	1.23E-01	7.88E-02	1.60E-01	2.52E-01
SU40	FR1800	1	Bailey Land	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU41	FR1800	2	Bailey Land	4.10E-02	0.00E+00	2.96E-02	0.00E+00	3.12E-02	0.00E+00	4.05E-02	0.00E+00
SU42	FR1800	3	Bailey Land	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU43	FR2900	1	Final Grade, Rails, Roads: East Plant Access Road & adjoining parking lots and roads	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE E-24
 Radionuclide Exposure Point Concentrations
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Area	Survey Unit	Survey Description	Source Concentration		Exposure Concentration (On-Site Resident)		Exposure Concentration (Worker)		Exposure Concentration (Construction Worker)	
				Cs-137 (pCi/g)	Co-60 (pCi/g)	Cs-137 (pCi/g)	Co-60 (pCi/g)	Cs-137 (pCi/g)	Co-60 (pCi/g)	Cs-137 (pCi/g)	Co-60 (pCi/g)
SU44	FR2900	2	Final Grade, Rails, Roads: West Access Rd & adjoining parking lots and roads	0.00E+00	4.20E-02	0.00E+00	1.04E-02	0.00E+00	1.23E-02	0.00E+00	3.94E-02
SU45	FR2900	3	Final Grade, Rails, Roads (south & west) & Staff Bld Parking Lot, Lots E,C	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU46	FB1400	1	Information Center	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU47	FB1500	1	Warehouse 2/3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU48	FB1700	1	Staff Building	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU49	FB1900	1	Bailey House Footprint	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU50	FB2000	1	Bailey Barn Footprint	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU51	FB2600	1	Warehouse 5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SU52	FA0400	1	Fuel Building Footprint	0.00E+00	1.33E-01	0.00E+00	3.31E-02	0.00E+00	3.90E-02	0.00E+00	1.25E-01

Decay Adjustment Factors	Cs-137	Co-60
On-site Resident	0.723	0.249
Worker	0.761	0.293
Construction Worker	0.989	0.937

TABLE E-25
 Radionuclide Exposure Factors
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Receptor	Pathway	Symbol	Units	Value	Description	Reference
Resident	Soil Ingestion	IR _{si}	mg/day	120	Soil ingestion rate (0.001 g/mg is a conversion factor)	EPA, 2001
		EF	days/year	150	Exposure frequency	RFI HHRA Table 5-4 (MYAPC, 2004)
		ED	years	30	Exposure duration	EPA, 2001
	Produce Ingestion	Ir _f	kg/yr	7.7	Exposed aboveground produce ingestion rate	EPA, 1998
		Ir _v	kg/yr	18.1	Sum of protected produce and root produce ingestion rates	EPA, 1998
		Ir _{lv}	kg/yr		Leafy vegetable ingestion rate	Included with exposed aboveground produce
		CPF	unitless	1	Contaminated plant fraction from site	
		B _f	unitless	nuclide-specific	Soil-to-plant transfer coefficient, for fruit	
		B _v	unitless	nuclide-specific	Soil-to-plant transfer coefficient, for protected/root vegetables	
		B _{lv}	unitless	nuclide-specific	Soil-to-plant transfer coefficient, for leafy vegetables	
	External Exposure	ACF	unitless	0.90	Area correction factor	EPA, 2001
		ET _o	unitless	0.073	Exposure time outdoors	EPA, 2001
		ET _i	unitless	0.683	Exposure time indoors	EPA, 2001
GSF		unitless	0.40	Indoor gamma shielding factor	EPA, 2001	
On-site worker	Soil Ingestion	IR _{si}	mg/day	100	Soil ingestion rate (0.001 g/mg is a conversion factor)	EPA, 1991
		EF	days/year	150	Exposure frequency	RFI HHRA Table 5-4 (MYAPC, 2004)
		ED	years	25	Exposure duration	EPA, 1991
	External Exposure	ACF	unitless	0.90	Area correction factor	EPA, 2001
		ET _o	unitless	0.167	Exposure time outdoors	Calculated value
		ET _i	unitless	0.167	Exposure time indoors	Calculated value
		GSF	unitless	0.40	Indoor gamma shielding factor	EPA, 2001
Construction worker	Soil Ingestion	IR _{si}	mg/day	330	Soil ingestion rate (0.001 g/mg is a conversion factor)	EPA, 2002
		EF	days/year	160	Exposure frequency	RFI HHRA Table 5-6 (MYAPC, 2004)
		ED	years	1	Exposure duration	RFI HHRA Table 5-6 (MYAPC, 2004)
	External Exposure	ACF	unitless	0.90	Area correction factor	EPA, 2001
		ET _o	unitless	0.333	Exposure time outdoors	Calculated value
		ET _i	unitless	0.000	Exposure time indoors	Calculated value
		GSF	unitless	0.40	Indoor gamma shielding factor	EPA, 2001

TABLE E-26

Total Chemical Carcinogenic Site Risks, Bailey Point RFI Report (MYAPC, 2004, Table 5-15)

Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Medium	Plant Area		Warehouse 2/3		345 kV Transmission Line		Bailey Farmhouse	
	CT	RME	CT	RME	CT	RME	CT	RME
Soils								
Soils	6.5E-06	4.8E-05	5.2E-06	3.8E-05	2.3E-06	1.5E-05	1.2E-06	7.9E-06
Produce	2.2E-04	2.2E-04	1.8E-04	1.8E-04	6.1E-05	6.1E-05	2.9E-05	2.9E-05
Sediments	6.0E-06	6.0E-06	6.0E-06	6.0E-06	6.0E-06	6.0E-06	6.0E-06	6.0E-06
Total Residential Site Risks Including Arsenic	2.3E-04	2.7E-04	1.9E-04	2.2E-04	6.9E-05	8.2E-05	3.6E-05	4.3E-05
Soils	4.8E-06	3.7E-05	3.1E-06	2.4E-05	3.8E-07	2.9E-06	0.00E+00	0.00E+00
Produce	1.8E-04	1.8E-04	1.3E-04	1.3E-04	1.2E-05	1.2E-05	0.00E+00	0.00E+00
Sediments	4.3E-06	4.3E-06	4.3E-06	4.3E-06	4.3E-06	4.3E-06	4.3E-06	4.3E-06
Total Residential Site Risks Excluding Arsenic	1.9E-04	2.2E-04	1.4E-04	1.6E-04	1.7E-05	1.9E-05	4.3E-06	4.3E-06
Total On-Site Worker Site Risks On-Site Worker - Excluding Arsenic	1.7E-06 1.3E-06	1.9E-05 1.5E-05	1.4E-06 8.2E-07	1.5E-05 9.9E-06	5.9E-07 9.9E-08	5.4E-06 1.2E-06	3.1E-07 0.0E+00	2.7E-06 0.0E+00
Total Construction Worker Site Risks	soil depth Surface	Subsurface	Surface	Subsurface	Surface	Subsurface	Surface	Subsurface
	1.9E-06	1.6E-06	1.5E-06	8.8E-07	6.4E-07	7.4E-07	3.4E-07	3.9E-07

		Sitewide Risks	
		CT	RME
Sediment			
	Shellfisherman	1.7E-06	1.4E-05
Groundwater		5.1E-05	6.1E-04
Tissue			
	Clams	2.0E-04	1.1E-03
	Mussels	7.2E-05	4.0E-04
	Lobster	1.6E-04	9.0E-04
	Tomally	2.6E-04	1.4E-03
	Reference Clams		1.1E-03
	Reference Mussels		4.9E-04

BOLD - total site cancer risks exceed the MDEP target risk of 1×10^{-5} .

CT - Central Tendency

RME - Reasonable Maximum Exposure

TABLE E-27

Cumulative Risks (Excess Lifetime Cancer Risk), All Scenarios, EU-1
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Area	Survey Unit	Survey Description	Radionuclide Risks (FGR-13/HEAST)			Chemical Risks			Cumulative Risks			Percent contribution to cumulative risks - radionuclides			Percent contribution to cumulative risks - chemicals		
				On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker
SU01	FR0100	1	Yard West (2)	0.00E+00	0.00E+00	0.00E+00	2.32E-04	1.70E-06	1.90E-06	2.32E-04	1.70E-06	1.90E-06	0.00%	0.00%	0.00%	100.00%	100.00%	100.00%
SU02	FR0100	2	Yard West (2)	1.42E-06	3.99E-07	7.76E-08	2.32E-04	1.70E-06	1.90E-06	2.34E-04	2.10E-06	1.98E-06	0.61%	19.01%	3.93%	99.39%	80.99%	96.07%
SU03	FR0100	3	Yard West	0.00E+00	0.00E+00	0.00E+00	2.32E-04	1.70E-06	1.90E-06	2.32E-04	1.70E-06	1.90E-06	0.00%	0.00%	0.00%	100.00%	100.00%	100.00%
SU04	FR0111	8	Soil Remediation Areas	0.00E+00	0.00E+00	0.00E+00	2.32E-04	1.70E-06	1.90E-06	2.32E-04	1.70E-06	1.90E-06	0.00%	0.00%	0.00%	100.00%	100.00%	100.00%
SU05	FR0111	9	Soil Remediation Areas	1.62E-06	4.54E-07	8.83E-08	2.32E-04	1.70E-06	1.90E-06	2.34E-04	2.15E-06	1.99E-06	0.69%	21.08%	4.44%	99.31%	78.92%	95.56%
SU06	FR0111	10	Soil Remediation Areas	2.01E-06	5.64E-07	1.10E-07	2.32E-04	1.70E-06	1.90E-06	2.34E-04	2.26E-06	2.01E-06	0.86%	24.91%	5.46%	99.14%	75.09%	94.54%
SU07	FR0111	11	Soil Remediation Areas	1.83E-06	5.14E-07	1.00E-07	2.32E-04	1.70E-06	1.90E-06	2.34E-04	2.21E-06	2.00E-06	0.78%	23.21%	5.00%	99.22%	76.79%	95.00%
SU08	FR0111	12	Soil Remediation Areas	1.69E-06	4.75E-07	9.25E-08	2.32E-04	1.70E-06	1.90E-06	2.34E-04	2.18E-06	1.99E-06	0.72%	21.85%	4.64%	99.28%	78.15%	95.36%
SU09	FR0111	13	Soil Remediation Areas	0.00E+00	0.00E+00	0.00E+00	2.32E-04	1.70E-06	1.90E-06	2.32E-04	1.70E-06	1.90E-06	0.00%	0.00%	0.00%	100.00%	100.00%	100.00%
SU10	FR0111	14	Soil Remediation Areas	1.46E-06	4.11E-07	7.99E-08	2.32E-04	1.70E-06	1.90E-06	2.34E-04	2.11E-06	1.98E-06	0.63%	19.46%	4.04%	99.37%	80.54%	95.96%
SU11	FR0111	15	Soil Remediation Areas	1.68E-06	4.71E-07	9.16E-08	2.32E-04	1.70E-06	1.90E-06	2.34E-04	2.17E-06	1.99E-06	0.72%	21.68%	4.60%	99.28%	78.32%	95.40%
SU12	FR0111	16	Soil Remediation Areas	2.22E-06	6.22E-07	1.21E-07	2.32E-04	1.70E-06	1.90E-06	2.35E-04	2.32E-06	2.02E-06	0.94%	26.79%	5.99%	99.06%	73.21%	94.01%
SU13	FR0111	17	Soil Remediation Areas	1.53E-06	4.30E-07	8.38E-08	2.32E-04	1.70E-06	1.90E-06	2.34E-04	2.13E-06	1.98E-06	0.66%	20.21%	4.22%	99.34%	79.79%	95.78%
SU14	FR0111	18	Soil Remediation Areas	0.00E+00	0.00E+00	0.00E+00	2.32E-04	1.70E-06	1.90E-06	2.32E-04	1.70E-06	1.90E-06	0.00%	0.00%	0.00%	100.00%	100.00%	100.00%
SU15	FR0111	19	Soil Remediation Areas	0.00E+00	0.00E+00	0.00E+00	2.32E-04	1.70E-06	1.90E-06	2.32E-04	1.70E-06	1.90E-06	0.00%	0.00%	0.00%	100.00%	100.00%	100.00%
SU16	FR0111	20	Soil Remediation Areas	2.42E-06	6.80E-07	1.32E-07	2.32E-04	1.70E-06	1.90E-06	2.35E-04	2.38E-06	2.03E-06	1.03%	28.58%	6.51%	98.97%	71.42%	93.49%
SU17	FR0200	1	Yard East	0.00E+00	0.00E+00	0.00E+00	2.32E-04	1.70E-06	1.90E-06	2.32E-04	1.70E-06	1.90E-06	0.00%	0.00%	0.00%	100.00%	100.00%	100.00%
SU18	FR0200	2	Yard East	0.00E+00	0.00E+00	0.00E+00	2.32E-04	1.70E-06	1.90E-06	2.32E-04	1.70E-06	1.90E-06	0.00%	0.00%	0.00%	100.00%	100.00%	100.00%
SU19	FR0200	3	Yard East	0.00E+00	0.00E+00	0.00E+00	2.32E-04	1.70E-06	1.90E-06	2.32E-04	1.70E-06	1.90E-06	0.00%	0.00%	0.00%	100.00%	100.00%	100.00%
SU20	FR0200	4	Yard East	1.52E-06	4.27E-07	8.30E-08	2.32E-04	1.70E-06	1.90E-06	2.34E-04	2.13E-06	1.98E-06	0.65%	20.06%	4.19%	99.35%	79.94%	95.81%
SU21	FR0200	5	Yard East	1.79E-06	5.02E-07	9.77E-08	2.32E-04	1.70E-06	1.90E-06	2.34E-04	2.20E-06	2.00E-06	0.76%	22.80%	4.89%	99.24%	77.20%	95.11%
SU22	FR0200	6	Yard East	1.66E-06	4.66E-07	9.06E-08	2.32E-04	1.70E-06	1.90E-06	2.34E-04	2.17E-06	1.99E-06	0.71%	21.51%	4.55%	99.29%	78.49%	95.45%
SU23	FR0200	7	Yard East	1.89E-06	5.31E-07	1.03E-07	2.32E-04	1.70E-06	1.90E-06	2.34E-04	2.23E-06	2.00E-06	0.81%	23.80%	5.16%	99.19%	76.20%	94.84%
SU24	FR0200	8	Yard East	1.54E-06	4.31E-07	8.39E-08	2.32E-04	1.70E-06	1.90E-06	2.34E-04	2.13E-06	1.98E-06	0.66%	20.24%	4.23%	99.34%	79.76%	95.77%
SU25	FR0200	9	Yard East	2.17E-06	6.10E-07	1.19E-07	2.32E-04	1.70E-06	1.90E-06	2.35E-04	2.31E-06	2.02E-06	0.93%	26.39%	5.88%	99.07%	73.61%	94.12%
SU30	FR0500	1	Bailey Point	0.00E+00	0.00E+00	0.00E+00	2.32E-04	1.70E-06	1.90E-06	2.32E-04	1.70E-06	1.90E-06	0.00%	0.00%	0.00%	100.00%	100.00%	100.00%
SU31	FR0500	2	Bailey Point	3.93E-06	9.51E-07	7.54E-08	2.32E-04	1.70E-06	1.90E-06	2.36E-04	2.65E-06	1.98E-06	1.66%	35.86%	3.81%	98.34%	64.14%	96.19%
SU34	FR0900	1	BOP Land (Land South of 345 Yard & Little Oak Is)	2.26E-07	5.47E-08	4.33E-09	2.32E-04	1.70E-06	1.90E-06	2.33E-04	1.75E-06	1.90E-06	0.10%	3.12%	0.23%	99.90%	96.88%	99.77%
SU36	FR0900	3	BOP Land	2.90E-06	7.02E-07	5.57E-08	2.32E-04	1.70E-06	1.90E-06	2.35E-04	2.40E-06	1.96E-06	1.23%	29.24%	2.85%	98.77%	70.76%	97.15%
SU52	FA0400	1	Fuel Building Footprint	3.72E-06	1.04E-06	2.03E-07	2.32E-04	1.70E-06	1.90E-06	2.36E-04	2.74E-06	2.10E-06	1.58%	38.06%	9.67%	98.42%	61.94%	90.33%

Maximum Case (radionuclide only)

3.93E-06 1.04E-06 2.03E-07

Maximum Case (cumulative and radionuclide risks)

2.36E-04 2.74E-06 2.10E-06

Range of Contribution of Radionuclides to Cumulative Risk (min and max)

0.00% 0.00% 0.00%
 1.66% 38.06% 9.67%

TABLE E-28

Cumulative Risks (Excess Lifetime Cancer Risk), All Scenarios, EU-2
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Area	Survey Unit	Survey Description	Radionuclide Risks (FGR-13/HEAST)			Chemical Risks			Cumulative Risks			Percent contribution to cumulative risks - radionuclides			Percent contribution to cumulative risks - chemicals		
				On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker
SU34	FR0900	1	BOP Land (Land South of 345 Yard & Little Oak Is)	2.26E-07	5.47E-08	4.33E-09	1.91E-04	1.40E-06	1.50E-06	1.91E-04	1.45E-06	1.50E-06	0.12%	3.76%	0.29%	99.88%	96.24%	99.71%
SU47	FB1500	1	Warehouse 2/3	0.00E+00	0.00E+00	0.00E+00	1.91E-04	1.40E-06	1.50E-06	1.91E-04	1.40E-06	1.50E-06	0.00%	0.00%	0.00%	100.00%	100.00%	100.00%
SU51	FB2600	1	Warehouse 5	0.00E+00	0.00E+00	0.00E+00	1.91E-04	1.40E-06	1.50E-06	1.91E-04	1.40E-06	1.50E-06	0.00%	0.00%	0.00%	100.00%	100.00%	100.00%

Maximum Case (radionuclide only)
 2.26E-07 5.47E-08 4.33E-09

Maximum Case (cumulative and radionuclide risks)
 1.91E-04 1.45E-06 1.50E-06

Range of Contribution of Radionuclides to Cumulative Risk (min and max)

TABLE E-29

Cumulative Risks (Excess Lifetime Cancer Risk), All Scenarios, EU-3
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Area	Survey Unit	Survey Description	Radionuclide Risks (FGR-13/HEAST)			Chemical Risks			Cumulative Risks			Percent contribution to cumulative risks - radionuclides			Percent contribution to cumulative risks - chemicals		
				On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker
SU40	FR1800	1	Bailey Land	0.00E+00	0.00E+00	0.00E+00	6.93E-05	5.90E-07	7.40E-07	6.93E-05	5.90E-07	7.40E-07	0.00%	0.00%	0.00%	100.00%	100.00%	100.00%
SU41	FR1800	2	Bailey Land	7.12E-07	1.72E-07	1.37E-08	6.93E-05	5.90E-07	7.40E-07	7.00E-05	7.62E-07	7.54E-07	1.02%	22.62%	1.81%	98.98%	77.38%	98.19%
SU43	FR2900	1	Final Grade, Rails, Roads: East Plant Access Road & adjoining parking lots and roads	0.00E+00	0.00E+00	0.00E+00	6.93E-05	5.90E-07	7.40E-07	6.93E-05	5.90E-07	7.40E-07	0.00%	0.00%	0.00%	100.00%	100.00%	100.00%
SU44	FR2900	2	Final Grade, Rails, Roads: West Access Rd & adjoining parking lots and roads	1.18E-06	3.30E-07	6.42E-08	6.93E-05	5.90E-07	7.40E-07	7.05E-05	9.20E-07	8.04E-07	1.67%	35.86%	7.98%	98.33%	64.14%	92.02%
SU45	FR2900	3	Final Grade, Rails, Roads (south & west) & Staff Bld Parking Lot, Lots E,C	0.00E+00	0.00E+00	0.00E+00	6.93E-05	5.90E-07	7.40E-07	6.93E-05	5.90E-07	7.40E-07	0.00%	0.00%	0.00%	100.00%	100.00%	100.00%

Maximum Case (radionuclide only)
 1.18E-06 3.30E-07 6.42E-08

Maximum Case (cumulative and radionuclide risks)			Range of Contribution of Radionuclides to Cumulative Risk (min and max)			
7.05E-05	9.20E-07	8.04E-07	0.00%	0.00%	0.00%	min
			1.67%	35.86%	7.98%	max

TABLE E-30

Cumulative Risks (Excess Lifetime Cancer Risk), All Scenarios, EU-4
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Area	Survey Unit	Survey Description	Radionuclide Risks (FGR-13/HEAST)			Chemical Risks			Cumulative Risks			Percent contribution to cumulative risks - radionuclides			Percent contribution to cumulative risks - chemicals		
				On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker
SU40	FR1800	1	Bailey Land	0.00E+00	0.00E+00	0.00E+00	3.62E-05	3.10E-07	3.90E-07	3.62E-05	3.10E-07	3.90E-07	0.00%	0.00%	0.00%	100.00%	100.00%	100.00%
SU41	FR1800	2	Bailey Land	7.12E-07	1.72E-07	1.37E-08	3.62E-05	3.10E-07	3.90E-07	3.69E-05	4.82E-07	4.04E-07	1.93%	35.75%	3.39%	98.07%	64.25%	96.61%
SU42	FR1800	3	Bailey Land	0.00E+00	0.00E+00	0.00E+00	3.62E-05	3.10E-07	3.90E-07	3.62E-05	3.10E-07	3.90E-07	0.00%	0.00%	0.00%	100.00%	100.00%	100.00%
SU43	FR2900	1	Final Grade, Rails, Roads: East Plant Access Road & adjoining parking lots and roads	0.00E+00	0.00E+00	0.00E+00	3.62E-05	3.10E-07	3.90E-07	3.62E-05	3.10E-07	3.90E-07	0.00%	0.00%	0.00%	100.00%	100.00%	100.00%
SU49	FB1900	1	Bailey House Footprint	0.00E+00	0.00E+00	0.00E+00	3.62E-05	3.10E-07	3.90E-07	3.62E-05	3.10E-07	3.90E-07	0.00%	0.00%	0.00%	100.00%	100.00%	100.00%
SU50	FB2000	1	Bailey Barn Footprint	0.00E+00	0.00E+00	0.00E+00	3.62E-05	3.10E-07	3.90E-07	3.62E-05	3.10E-07	3.90E-07	0.00%	0.00%	0.00%	100.00%	100.00%	100.00%

Maximum Case (radionuclide only)
 7.12E-07 1.72E-07 1.37E-08

Maximum Case (cumulative and radionuclide risks)
 3.69E-05 4.82E-07 4.04E-07

Range of Contribution of Radionuclides to Cumulative Risk (min and max)

TABLE E-31

Cumulative Risks (Excess Lifetime Cancer Risk), All Scenarios, EU-5
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Area	Survey Unit	Survey Description	Radionuclide Risks (FGR-13/HEAST)			Chemical Risks			Cumulative Risks			Percent contribution to cumulative risks - radionuclides			Percent contribution to cumulative risks - chemicals		
				On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker
SU40	FR1800	1	Bailey Land	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00						

Maximum Case (radionuclide only)
 0.00E+00 0.00E+00 0.00E+00

Maximum Case (cumulative and radionuclide risks)
 0.00E+00 0.00E+00 0.00E+00

TABLE E-32

Cumulative Risks (Excess Lifetime Cancer Risk), All Scenarios, EU-6
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Area	Survey Unit	Survey Description	Radionuclide Risks (FGR-13/HEAST)			Chemical Risks			Cumulative Risks			Percent contribution to cumulative risks - radionuclides			Percent contribution to cumulative risks - chemicals		
				On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker
SU32	FR0800	1	Admin and Parking Areas	2.18E-06	6.12E-07	1.19E-07	0.00E+00	0.00E+00	0.00E+00	2.18E-06	6.12E-07	1.19E-07						
SU33	FR0810	1	Collection Site Sub Slab	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00						
SU34	FR0900	1	BOP Land (Land South of 345 Yard & Little Oak Is)	2.26E-07	5.47E-08	4.33E-09	0.00E+00	0.00E+00	0.00E+00	2.26E-07	5.47E-08	4.33E-09						
SU35	FR0900	2	BOP Land	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00						
SU37	FR0900	4	BOP Land	1.83E-06	5.14E-07	1.00E-07	0.00E+00	0.00E+00	0.00E+00	1.83E-06	5.14E-07	1.00E-07						
SU38	FR0910	1	Fire Pond	2.16E-06	6.06E-07	1.18E-07	0.00E+00	0.00E+00	0.00E+00	2.16E-06	6.06E-07	1.18E-07						
SU41	FR1800	2	Bailey Land	7.12E-07	1.72E-07	1.37E-08	0.00E+00	0.00E+00	0.00E+00	7.12E-07	1.72E-07	1.37E-08						
SU43	FR2900	1	Final Grade, Rails, Roads: East Plant Access Road & adjoining parking lots and roads	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00						
SU44	FR2900	2	Final Grade, Rails, Roads: West Access Rd & adjoining parking lots and roads	1.18E-06	3.30E-07	6.42E-08	0.00E+00	0.00E+00	0.00E+00	1.18E-06	3.30E-07	6.42E-08						
SU45	FR2900	3	Final Grade, Rails, Roads (south & west) & Staff Bld Parking Lot, Lots E,C	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00						
SU46	FB1400	1	Information Center	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00						
SU48	FB1700	1	Staff Building	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00						

Maximum Case (radionuclide only)	Maximum Case (cumulative and radionuclide risks)
2.18E-06 6.12E-07 1.19E-07	2.18E-06 6.12E-07 1.19E-07

TABLE E-33

Cumulative Risks (Excess Lifetime Cancer Risk), All Scenarios, EU-7
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Area	Survey Unit	Survey Description	Radionuclide Risks (FGR-13/HEAST)			Chemical Risks			Cumulative Risks			Percent contribution to cumulative risks - radionuclides			Percent contribution to cumulative risks - chemicals		
				On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker
SU39	FR1000	0	Foxbird Island	1.03E-05	2.79E-06	4.65E-07	0.00E+00	0.00E+00	0.00E+00	1.03E-05	2.79E-06	4.65E-07						

Maximum Case (radionuclide only)
 1.03E-05 2.79E-06 4.65E-07

Maximum Case (cumulative and radionuclide risks)
 1.03E-05 2.79E-06 4.65E-07

TABLE E-34

Cumulative Risks (Excess Lifetime Cancer Risk), All Scenarios, EU-8
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Survey Unit Designation	Survey Area	Survey Unit	Survey Description	Radionuclide Risks (FGR-13/HEAST)			Chemical Risks			Cumulative Risks			Percent contribution to cumulative risks - radionuclides			Percent contribution to cumulative risks - chemicals		
				On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker	On-Site Resident	On-Site Worker	Construction Worker
SU03	FR0100	3	Yard West	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00						
SU26	FR0400	1	Forebay Seal Pit Floor	1.74E-05	4.80E-06	8.74E-07	0.00E+00	0.00E+00	0.00E+00	1.74E-05	4.80E-06	8.74E-07						
SU27	FR0400	2	Forebay Seal Pit Slopes	2.05E-06	5.77E-07	1.12E-07	0.00E+00	0.00E+00	0.00E+00	2.05E-06	5.77E-07	1.12E-07						
SU39	FR1000	0	Foxbird Island	1.03E-05	2.79E-06	4.65E-07	0.00E+00	0.00E+00	0.00E+00	1.03E-05	2.79E-06	4.65E-07						

Maximum Case (radionuclide only)	Maximum Case (cumulative and radionuclide risks)
1.74E-05 4.80E-06 8.74E-07	1.74E-05 4.80E-06 8.74E-07

Appendix F
Cumulative Risk Assessment Calculations -
Groundwater

TABLE F-1
 Cumulative Risk Assessment Summary in Groundwater Based on Dose-to-Risk Conversion (FGR11 Methodology)
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

		Estimated Lifetime Cancer Risk in Drinking Water															
Period	Year-Rnd	206A	306	318A	318B	401A	401B	401C	402	501	503	504	505A	505B	506	506C	502
1	2005-1st	1.99E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.51E-09	1.01E-08	0.00E+00	2.07E-09	8.35E-09	1.77E-08	7.15E-09	1.08E-09	1.90E-08	8.42E-09	8.44E-07
2	2006-1st	3.06E-08	0.00E+00	6.30E-09	0.00E+00	7.06E-09	1.12E-08	1.28E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.98E-08	0.00E+00	0.00E+00	1.69E-08	1.48E-06
3	2006-2nd	0.00E+00	0.00E+00	6.98E-08	0.00E+00	9.62E-09	1.24E-07	8.51E-08	0.00E+00	1.44E-09	1.27E-07	2.51E-08	1.11E-08	1.12E-07	4.73E-08	1.15E-07	1.33E-06
	Average	1.68E-08	0.00E+00	2.54E-08	0.00E+00	5.56E-09	4.81E-08	3.60E-08	0.00E+00	1.17E-09	4.52E-08	1.43E-08	1.27E-08	3.76E-08	2.21E-08	4.67E-08	1.22E-06
	Maximum	3.06E-08	0.00E+00	6.98E-08	0.00E+00	9.62E-09	1.24E-07	8.51E-08	0.00E+00	2.07E-09	1.27E-07	2.51E-08	1.98E-08	1.12E-07	4.73E-08	1.15E-07	1.48E-06
The above table calculates the dose of all positive detections above the MDA values committed to in the FERC Agreement. The table below calculates the dose of all positive detections even if they are below those MDA values (ie. Better MDA's were actually achieved.)																	
1	2005-1st	1.99E-08	1.66E-07	3.10E-09	0.00E+00	0.00E+00	8.51E-09	1.01E-08	0.00E+00	2.07E-09	8.35E-09	1.77E-08	7.15E-09	1.08E-09	1.90E-08	8.42E-09	8.44E-07
2	2006-1st	6.94E-08	0.00E+00	4.78E-08	3.82E-11	7.06E-09	1.12E-08	1.28E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.98E-08	0.00E+00	0.00E+00	1.69E-08	1.57E-06
3	2006-2nd	3.59E-08	0.00E+00	6.98E-08	1.63E-08	9.62E-09	1.24E-07	8.51E-08	0.00E+00	1.44E-09	1.27E-07	6.85E-08	1.11E-08	1.12E-07	9.83E-08	1.15E-07	1.37E-06
	Average	4.17E-08	5.54E-08	4.02E-08	5.44E-09	5.56E-09	4.81E-08	3.60E-08	0.00E+00	1.17E-09	4.52E-08	2.87E-08	1.27E-08	3.76E-08	3.91E-08	4.67E-08	1.26E-06
	Maximum	6.94E-08	1.66E-07	6.98E-08	1.63E-08	9.62E-09	1.24E-07	8.51E-08	0.00E+00	2.07E-09	1.27E-07	6.85E-08	1.98E-08	1.12E-07	9.83E-08	1.15E-07	1.57E-06

Conversion Factor: 8.00E-07 risk/mrem

TABLE F-2
Doses in Groundwater from Drinking Water Ingestion (FGR11 Methodology)
Cumulative Risk Assessment
Maine Yankee Facility, Wiscasset, ME

Per	Year-Rnd	Estimated Doses Associated with Drinking Water Ingestion (mrem/year)															
		206A	306	318A	318B	401A	401B	401C	402	501	503	504	505A	505B	506	506C	502
1	2005-1st	2.49E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.06E-02	1.26E-02	0.00E+00	2.58E-03	1.04E-02	2.21E-02	8.94E-03	1.35E-03	2.37E-02	1.05E-02	1.06E+00
2	2006-1st	3.83E-02	0.00E+00	7.87E-03	0.00E+00	8.83E-03	1.40E-02	1.59E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.47E-02	0.00E+00	0.00E+00	2.11E-02	1.85E+00
3	2006-2nd	0.00E+00	0.00E+00	8.73E-02	0.00E+00	1.20E-02	1.56E-01	1.06E-01	0.00E+00	1.80E-03	1.59E-01	3.13E-02	1.39E-02	1.40E-01	5.92E-02	1.44E-01	1.67E+00
	Average	2.11E-02	0.00E+00	3.17E-02	0.00E+00	6.95E-03	6.01E-02	4.50E-02	0.00E+00	1.46E-03	5.65E-02	1.78E-02	1.58E-02	4.70E-02	2.76E-02	5.84E-02	1.53E+00
	Maximum	3.83E-02	0.00E+00	8.73E-02	0.00E+00	1.20E-02	1.56E-01	1.06E-01	0.00E+00	2.58E-03	1.59E-01	3.13E-02	2.47E-02	1.40E-01	5.92E-02	1.44E-01	1.85E+00
The above table calculates the dose of all positive detections above the MDA values committed to in the FERC Agreement. The table below calculates the dose of all positive detections even if they are below those MDA values (ie. Better MDA's were actually achieved.)																	
1	2005-1st	2.49E-02	2.08E-01	3.88E-03	0.00E+00	0.00E+00	1.06E-02	1.26E-02	0.00E+00	2.58E-03	1.04E-02	2.21E-02	8.94E-03	1.35E-03	2.37E-02	1.05E-02	1.06E+00
2	2006-1st	8.67E-02	0.00E+00	5.97E-02	4.78E-05	8.83E-03	1.40E-02	1.59E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.47E-02	0.00E+00	0.00E+00	2.11E-02	1.96E+00
3	2006-2nd	4.49E-02	0.00E+00	8.73E-02	2.04E-02	1.20E-02	1.56E-01	1.06E-01	0.00E+00	1.80E-03	1.59E-01	8.56E-02	1.39E-02	1.40E-01	1.23E-01	1.44E-01	1.71E+00
	Average	5.22E-02	6.93E-02	5.03E-02	6.80E-03	6.95E-03	6.01E-02	4.50E-02	0.00E+00	1.46E-03	5.65E-02	3.59E-02	1.58E-02	4.70E-02	4.89E-02	5.84E-02	1.58E+00
	Maximum	8.67E-02	2.08E-01	8.73E-02	2.04E-02	1.20E-02	1.56E-01	1.06E-01	0.00E+00	2.58E-03	1.59E-01	8.56E-02	2.47E-02	1.40E-01	1.23E-01	1.44E-01	1.96E+00

TABLE F-3
Calculations for Dose-to-Risk Conversion for Groundwater Risks (FGR11 Methodology)
Cumulative Risk Assessment
Maine Yankee Facility, Wiscasset, ME

	ASLB MDA's pCi/L	ASLB Env. LLD's ODCM T2.4 pCi/L	ODCM Rept Lvl's ODCM T2.5 pCi/L	FGR-11			EPA MCL's pCi/L	EPA Detect 40CFR pCi/L	Maine Yankee Groundwater Sampling Results								
				DCF's Sv/Bq	DCF's (LTP Values) mrem/pCi	4 mrem Equivalent pCi/L			Average MDA	Dose of Ave. MDA	Highest MDA pCi/L	Dose of Max MDA mrem	Lowest MDA pCi/L	Dose of Min MDA mrem	Positive Results pCi/L	Dose of Positive mrem	
ASLB HTD's																	ASLB HTD's
Gross Alpha	10	4					15		8.550		12.000		5.600				Gross Alpha
H-3	1,000	2,000	20,000	1.730E-11	6.407E-08	130,602	20,000	1,000	388.333	0.0119	460.000	0.0141	260.000	0.0080	1530	0.0469	H-3
C-14	500			5.640E-10	2.089E-06	4,006	2000	200		0.0000		0.0000		0.0000			C-14
Fe-55	1,000			1.640E-10	6.074E-07	13,777	2000	200	9.050	0.0026	11.000	0.0032	7.000	0.0020			Fe-55
Ni-59	50,000			5.670E-11	2.100E-07	39,849	300	30	2450.000	0.2459	4900.000	0.4919	1400.000	0.1405			Ni-59
Ni-63	1,000			1.560E-10	5.778E-07	14,483	50	5	13.092	0.0036	19.000	0.0052	7.900	0.0022			Ni-63
Sr-89	500			2.500E-09	9.259E-06	904	20	10	57.000	0.2523	150.000	0.6639	17.000	0.0752			Sr-89
Sr-90	500			3.850E-08	1.426E-04	59	8	2	7.742	0.5277	23.000	1.5677	1.400	0.0954			Sr-90
Tc-99	1,000			3.950E-10	1.463E-06	5,720	900	90	157.658	0.1102	520.000	0.3636	1.900	0.0013			Tc-99
Pu-238	10			8.650E-07	3.204E-03	3			0.183	0.2795	0.290	0.4441	0.110	0.1685			Pu-238
Pu-239	10			9.560E-07	3.541E-03	2			0.218	0.3681	0.300	0.5077	0.170	0.2877			Pu-239
Pu-240	10			9.560E-07	3.541E-03	2			0.218	0.3681	0.300	0.5077	0.170	0.2877			Pu-240
Pu-241	100			1.850E-08	6.852E-05	122	300	30	21.083	0.6905	60.000	1.9651	13.000	0.4258			Pu-241
Am-241	5			9.840E-07	3.644E-03	2			0.248	0.4326	0.280	0.4878	0.200	0.3484			Am-241
Cm-242	5			3.100E-08	1.148E-04	73			0.086	0.0047	0.120	0.0066	0.059	0.0032			Cm-242
Cm-243	5			6.790E-07	2.515E-03	3			0.082	0.0991	0.130	0.1563	0.049	0.0589			Cm-243
Cm-244	5			5.450E-07	2.019E-03	4			0.082	0.0795	0.130	0.1254	0.049	0.0473			Cm-244
I-129	200			7.460E-08	2.763E-04	30	1		50.000	6.6035	110.000	14.5277	10.000	1.3207			I-129
ASLB Gamma's																	ASLB Gamma's
Mn-54		15	1,000	7.480E-10	2.770E-06	3,021	300	30	1.858	0.0025	3.400	0.0045	1.100	0.0015			Mn-54
Co-58		15	1,000	9.680E-10	3.585E-06	2,334	300	30	2.100	0.0036	3.500	0.0060	1.400	0.0024			Co-58
Co-60		15	300	7.280E-09	2.696E-05	310	100	10	1.958	0.0252	3.800	0.0490	1.100	0.0142	7.7	0.09924	Co-60
Fe-59		30		1.810E-09	6.704E-06	1,248	200	20	6.692	0.0214	10.000	0.0320	4.400	0.0141			Fe-59
Zn-65		30		3.900E-09	1.444E-05	579	300	30	4.842	0.0334	10.000	0.0690	2.600	0.0180			Zn-65
Zr-95		15	400	1.020E-09	3.778E-06	2,215	200	20	3.742	0.0068	5.700	0.0103	2.700	0.0049			Zr-95
Nb-95		15	400	6.950E-10	2.574E-06	3,251	300	30	3.333	0.0041	7.400	0.0091	2.000	0.0025			Nb-95
Cs-134		15	30	1.980E-08	7.333E-05	114	80	10	1.850	0.0648	3.600	0.1262	1.200	0.0421			Cs-134
Cs-137		18	50	1.350E-08	5.000E-05	167	200	20	1.800	0.0430	3.500	0.0837	1.200	0.0287	2.3	0.05497	Cs-137
Ba-140		15	200	2.560E-09	9.481E-06	883	90	9	14.575	0.0661	45.000	0.2039	5.900	0.0267			Ba-140
La-140		15	200	2.280E-09	8.444E-06	991	60	6	14.575	0.0588	45.000	0.1816	5.900	0.0238			La-140
Annual Drinking Water		478	L/yr														

Conversion
Factors

100000 mrem/Sv
27 pCi/Bq

TABLE F-4
 Cumulative Risk Assessment Summary in Groundwater (FGR13 Methodology)
 Cumulative Risk Assessment
 Maine Yankee Facility, Wiscasset, ME

Per	Year-Rnd	Estimated Lifetime Cancer Risk															
		206A	306	318A	318B	401A	401B	401C	402	501	503	504	505A	505B	506	506C	502
1	2005-1st	3.97E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.70E-08	2.01E-08	0.00E+00	2.12E-09	1.67E-08	3.04E-08	7.08E-09	1.07E-09	2.13E-08	1.68E-08	8.35E-07
2	2006-1st	6.11E-08	0.00E+00	6.23E-09	0.00E+00	1.07E-08	2.24E-08	2.55E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.07E-08	0.00E+00	0.00E+00	0.00E+00	1.46E-06
3	2006-2nd	0.00E+00	0.00E+00	5.08E-08	0.00E+00	2.60E-08	1.13E-07	6.87E-08	0.00E+00	1.50E-09	1.23E-07	2.54E-08	1.10E-08	9.86E-08	4.94E-08	1.02E-07	1.30E-06
	Average	3.36E-08	0.00E+00	1.90E-08	0.00E+00	1.22E-08	5.07E-08	3.81E-08	0.00E+00	1.21E-09	4.64E-08	1.86E-08	1.62E-08	3.32E-08	2.36E-08	3.96E-08	1.20E-06
	Maximum	6.11E-08	0.00E+00	5.08E-08	0.00E+00	2.60E-08	1.13E-07	6.87E-08	0.00E+00	2.12E-09	1.23E-07	3.04E-08	3.07E-08	9.86E-08	4.94E-08	1.02E-07	1.46E-06
		The above table calculates the dose of all positive detections above the MDA values committed to in the FERC Agreement. The table below calculates the dose of all positive detections even if they are below those MDA values (ie. Better MDA's were actually achieved.)															
1	2005-1st	3.97E-08	8.15E-08	6.93E-09	0.00E+00	0.00E+00	1.70E-08	2.01E-08	0.00E+00	2.12E-09	1.67E-08	3.04E-08	7.08E-09	1.07E-09	2.13E-08	1.68E-08	8.35E-07
2	2006-1st	8.93E-08	0.00E+00	3.78E-08	2.91E-11	1.07E-08	2.24E-08	2.55E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.07E-08	0.00E+00	0.00E+00	2.48E-08	1.46E-06
3	2006-2nd	2.61E-08	0.00E+00	5.08E-08	1.19E-08	2.60E-08	1.13E-07	6.87E-08	0.00E+00	1.50E-09	1.23E-07	5.70E-08	1.10E-08	9.86E-08	8.65E-08	1.02E-07	1.35E-06
	Average	5.17E-08	2.72E-08	3.18E-08	3.96E-09	1.22E-08	5.07E-08	3.81E-08	0.00E+00	1.21E-09	4.64E-08	2.91E-08	1.62E-08	3.32E-08	3.59E-08	4.79E-08	1.22E-06
	Maximum	8.93E-08	8.15E-08	5.08E-08	1.19E-08	2.60E-08	1.13E-07	6.87E-08	0.00E+00	2.12E-09	1.23E-07	5.70E-08	3.07E-08	9.86E-08	8.65E-08	1.02E-07	1.46E-06

TABLE F-5
Calculations for Groundwater Risks (FGR13 Methodology)
Cumulative Risk Assessment
Maine Yankee Facility, Wiscasset, ME

	ASLB MDA's pCi/L	ASLB Env. LLD's ODCM T2.4 pCi/L	ODCM Rept Lvl's ODCM T2.5 pCi/L	FGR-13			EPA MCL's pCi/L	EPA Detect 40CFR pCi/L	Maine Yankee Groundwater Sampling Results								
				DCF's Sv/Bq	DCF's Heast Table Risk/pCi	DCF * Liter/y Risk*L/pCi			Average MDA	Risk of Ave. MDA	Highest MDA pCi/L	Risk of Max MDA mrem	Lowest MDA pCi/L	Risk of Min MDA mrem	Positive Results pCi/L	Risk of Positive mrem	
ASLB HTD's																	ASLB HTD's
Gross Alpha	10	4					15		8.550		12.000		5.600				Gross Alpha
H-3	1,000	2,000	20,000		5.07E-14	2.42E-11	20,000	1,000	388.333	9.41E-09	460.000	1.11E-08	260.000	6.30E-09	1530	3.71E-08	H-3
C-14	500				1.55E-12	7.41E-10	2000	200		0.00E+00		0.00E+00		0.00E+00			C-14
Fe-55	1,000				8.62E-13	4.12E-10	2000	200	9.050	3.73E-09	11.000	4.53E-09	7.000	2.88E-09			Fe-55
Ni-59	50,000				2.74E-13	1.31E-10	300	30	2450.000	3.21E-07	4900.000	6.42E-07	1400.000	1.83E-07			Ni-59
Ni-63	1,000				6.70E-13	3.20E-10	50	5	13.092	4.19E-09	19.000	6.08E-09	7.900	2.53E-09			Ni-63
Sr-89	500				1.28E-11	6.12E-09	20	10	57.000	3.49E-07	150.000	9.18E-07	17.000	1.04E-07			Sr-89
Sr-90	500				5.59E-11	2.67E-08	8	2	7.742	2.07E-07	23.000	6.15E-07	1.400	3.74E-08			Sr-90
Tc-99	1,000				2.75E-12	1.31E-09	900	90	157.658	2.07E-07	520.000	6.84E-07	1.900	2.50E-09			Tc-99
Pu-238	10				1.31E-10	6.26E-08			0.183	1.14E-08	0.290	1.82E-08	0.110	6.89E-09			Pu-238
Pu-239	10				1.35E-10	6.45E-08			0.218	1.40E-08	0.300	1.94E-08	0.170	1.10E-08			Pu-239
Pu-240	10				1.35E-10	6.45E-08			0.218	1.40E-08	0.300	1.94E-08	0.170	1.10E-08			Pu-240
Pu-241	100				1.76E-12	8.41E-10	300	30	21.083	1.77E-08	60.000	5.05E-08	13.000	1.09E-08			Pu-241
Am-241	5				1.04E-10	4.97E-08			0.248	1.23E-08	0.280	1.39E-08	0.200	9.94E-09			Am-241
Cm-242	5				3.85E-11	1.84E-08			0.086	1.59E-09	0.120	2.21E-09	0.059	1.09E-09			Cm-242
Cm-243	5				9.47E-11	4.53E-08			0.082	3.73E-09	0.130	5.88E-09	0.049	2.22E-09			Cm-243
Cm-244	5				8.36E-11	4.00E-08			0.082	3.29E-09	0.130	5.19E-09	0.049	1.96E-09			Cm-244
I-129	200				1.48E-10	7.07E-08	1		50.000	3.54E-06	110.000	7.78E-06	10.000	7.07E-07			I-129
ASLB Gamma's																	ASLB Gamma's
Mn-54		15	1,000		2.28E-12	1.09E-09	300	30	1.858	2.03E-09	3.400	3.71E-09	1.100	1.20E-09			Mn-54
Co-58		15	1,000		2.95E-12	1.41E-09	300	30	2.100	2.96E-09	3.500	4.94E-09	1.400	1.97E-09			Co-58
Co-60		15	300		1.57E-11	7.50E-09	100	10	1.958	1.47E-08	3.800	2.85E-08	1.100	8.26E-09	7.7	4.1E+09	Co-60
Fe-59		30			7.88E-12	3.77E-09	200	20	6.692	2.52E-08	10.000	3.77E-08	4.400	1.66E-08			Fe-59
Zn-65		30			1.17E-11	5.59E-09	300	30	4.842	2.71E-08	10.000	5.59E-08	2.600	1.45E-08			Zn-65
Zr-95		15	400		4.59E-12	2.19E-09	200	20	3.742	8.21E-09	5.700	1.25E-08	2.700	5.92E-09			Zr-95
Nb-95		15	400		2.45E-12	1.17E-09	300	30	3.333	3.90E-09	7.400	8.67E-09	2.000	2.34E-09			Nb-95
Cs-134		15	30		4.22E-11	2.02E-08	80	10	1.850	3.73E-08	3.600	7.26E-08	1.200	2.42E-08			Cs-134
Cs-137		18	50		3.04E-11	1.45E-08	200	20	1.800	2.62E-08	3.500	5.09E-08	1.200	1.74E-08	2.3	6.3E+08	Cs-137
Ba-140		15	200		1.49E-11	7.12E-09	90	9	14.575	1.04E-07	45.000	3.20E-07	5.900	4.20E-08			Ba-140
La-140		15	200		1.10E-11	5.26E-09	60	6	14.575	7.66E-08	45.000	2.37E-07	5.900	3.10E-08			La-140
Annual Drinking Water		478	L/yr														

Conversion
Factors

100000 mrem/Sv
27 pCi/Bq

TABLE F-6

Comparison of Groundwater Risks - Dose-to-Risk (FGR11 Methodology) and Direct Calculation (FGR13 Methodology)
Cumulative Risk Assessment

Maine Yankee Facility, Wiscasset, ME

Monitoring Well	Average of Sampling Periods		Maximum Sampling Period	
	FGR-11	FGR-13	FGR-11	FGR-13
206A	4.17E-08	5.17E-08	6.94E-08	8.93E-08
306	5.54E-08	2.72E-08	1.66E-07	<u>8.15E-08</u>
318A	4.02E-08	3.18E-08	6.98E-08	5.08E-08
318B	5.44E-09	3.96E-09	1.63E-08	1.19E-08
401A	5.56E-09	1.22E-08	9.62E-09	2.60E-08
401B	4.81E-08	5.07E-08	1.24E-07	1.13E-07
401C	3.60E-08	3.81E-08	8.51E-08	6.87E-08
402	0.00E+00	0.00E+00	0.00E+00	0.00E+00
501	1.17E-09	1.21E-09	2.07E-09	2.12E-09
503	4.52E-08	4.64E-08	1.27E-07	1.23E-07
504	2.87E-08	2.91E-08	6.85E-08	5.70E-08
505A	1.27E-08	1.62E-08	1.98E-08	3.07E-08
505B	3.76E-08	3.32E-08	1.12E-07	9.86E-08
506	3.91E-08	3.59E-08	9.83E-08	8.65E-08
506C	4.67E-08	4.79E-08	1.15E-07	1.02E-07
502	1.26E-06	1.22E-06	1.57E-06	1.46E-06