YANKEE ATOMIC ELECTRIC COMPANY

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September 1, 2006
BYR 2006-075

Massachusetts Department of Environmental Protection
DEP Western Region
436 Dwight Street
Suite 402
Springfield, MA 01103

Attention: Mr. David Howland

Subject: Groundwater Monitoring Plan to Support Closure under the Massachusetts Contingency Plan

Dear Mr. Howland:

Please find enclosed three (3) copies of the "*Groundwater Monitoring Plan to Support Closure under the Massachusetts Contingency Plan*" (GMP-MCP) for Department review, comment and/or approval. The GMP-MCP was prepared at the request of the Massachusetts Department of Environmental Protection (Department) and presents Yankee Atomic Electric Company's (YAEC's) proposed plans for groundwater monitoring necessary to support closure of the Yankee Nuclear Power Station (YNPS) site in Rowe, Massachusetts in accordance with the requirements of the Massachusetts Contingency Plan (MCP, 310 CMR 40.0000) for a Permanent Solution.

As you are aware, YAEC has prepared a separate plan, "*Groundwater Compliance Plan For License Termination Plan For The Yankee Nuclear Power Station*", (GMP-LTP) that outlines plans to conduct groundwater monitoring to satisfy Nuclear Regulatory Commission (NRC) requirements for License Termination. The GMP-LTP document is included as Appendix A of the GMP-MCP.

Should you have questions or require additional information, please contact us.

Sincerely,

YANKEE ATOMIC ELECTRIC COMPANY

Joseph R. Lynch
Regulatory Affairs Manager

Attachment: Groundwater Monitoring Plan to Support Closure under the Massachusetts Contingency Plan

cc:

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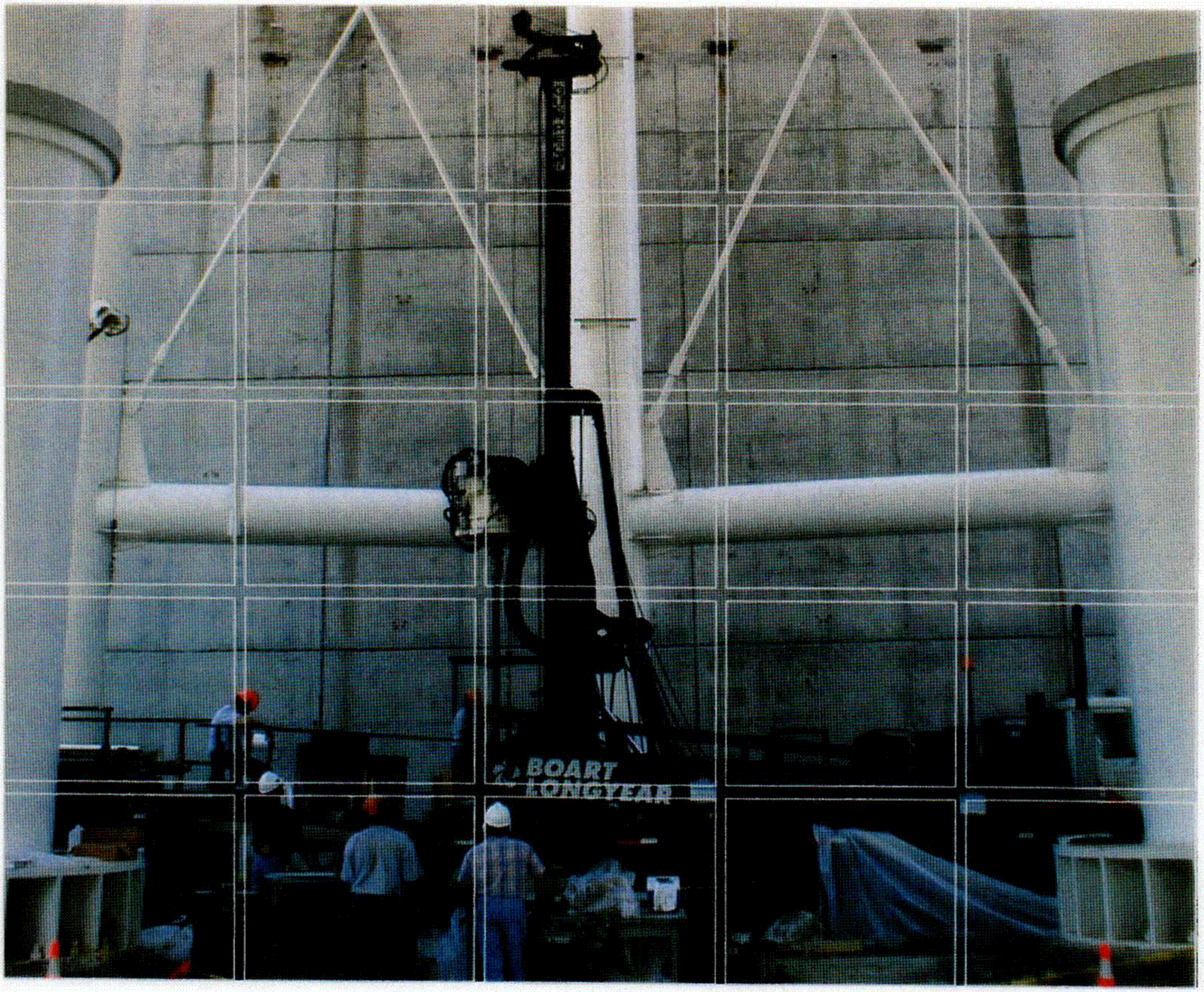

Groundwater Monitoring Plan to Support Closure under the Massachusetts Contingency Plan

Yankee Nuclear Power Station
Site Closure Project
Rowe, Massachusetts

1 September 2006

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Yankee Atomic Electric Company

Groundwater Monitoring Plan to Support Closure under the Massachusetts Contingency Plan

Yankee Nuclear Power Station Site Closure Project Rowe, Massachusetts

1 September 2006

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TABLES

FIGURES

APPENDICES

EXECUTIVE SUMMARY

Yankee Atomic Electric Company (YAEC) retained Environmental Resources Management (ERM) to prepare this *Groundwater Monitoring Plan to Support Closure under the Massachusetts Contingency Plan* (GMP-MCP) for the Yankee Nuclear Power Station (YNPS) located in Rowe, Massachusetts (the "site"). This GMP-MCP was prepared to support Massachusetts Department of Environmental Protection's (MA DEP's) review and approval of proposed plans for long-term groundwater monitoring at the YNPS. YAEC has prepared a separate plan, *Groundwater Compliance Plan For License Termination Plan For The Yankee Nuclear Power Station,* to outline plans to conduct groundwater monitoring to satisfy Nuclear Regulatory Commission (NRC) requirements (Appendix A).

A total of 78 groundwater monitoring wells have been installed at the site since 1977. Of those, 25 have been closed during the course of decommissioning activities. YAEC is installing three additional shallow monitoring wells to support site closure.

The GMP-MCP outlines plans for sampling groundwater for radiological parameters and Oil and/or Hazardous Materials (OHM). Groundwater sampling will be conducted at least annually. A more frequent sampling program may be implemented if deemed appropriate to facilitate site closure (e.g., sampling rounds could be conducted annually, semi-annually, or at a maximum frequency, quarterly).

Based on a review of historic data, tritium was the only radiological parameter carried forward in the GMP-MCP. Sampling will be performed at the one well (MW-107C) where tritium has been detected above the Maximum Contaminant Level (MCL), along with eight other wells where tritium has been detected at 25% of the MCL. Monitoring for tritium will be performed at least annually at MW-107C until results from four consecutive quarterly rounds completed over a one-year period are below the MCL. Monitoring will be performed at the other eight wells until monitoring is completed at MW-107C, or when the tritium concentration is less than 25% of the MCL for two consecutive sampling events.

Results of historic monitoring for OHM were compared to the Massachusetts Contingency Plan (MCP) Reportable Concentrations for Groundwater Category GW-1 (RCGW-1). Results indicate sporadic detections of OHM above RCGW-1 that were generally not repeatable, not associated with a release condition, or due to well integrity issues (e.g., polychlorinated biphenyl-containing paint chips found in damaged wells, glue used in above ground temporary risers during re-grading, etc.). Nonetheless, sampling for OHM constituents will be conducted at least annually at 19 monitoring wells. Monitoring will be conducted until the results of two consecutive sampling events demonstrate that OHM levels are below RCGW-1 Standards (or an alternative risk-based standard agreed to by YAEC and MA DEP).

1.0 *PURPOSE & SCOPE*

Yankee Atomic Electric Company (YAEC) retained Environmental Resources Management (ERM) to prepare this *Groundwater Monitoring Plan to Support Closure under the Massachusetts Contingency Plan* (GMP-MCP) for the Yankee Nuclear Power Station (YNPS) located in Rowe, Massachusetts (the "site") (Figure 1). This GMP-MCP was prepared to support Massachusetts Department of Environmental Protection's (MA DEP's) review and approval of proposed plans for long-term groundwater monitoring at the YNPS. This plan includes:

Section 2.0 Summary of Groundwater Monitoring at YNPS

A description of the history of groundwater monitoring, the existing well network, site geology and hydrogeology, and a brief summary of the known nature and extent and fate and transport of contaminants in site groundwater.

Section 3.0 Groundwater Regulatory Requirements & Proposed Compliance Plan

A brief summary of state and federal regulatory requirements governing groundwater monitoring, criteria for termination of monitoring and YAEC's proposed pathway to satisfy regulatory requirements.

Section 4.0 YNPS Proposed Groundwater Monitoring Plan

A summary of proposed monitoring locations, frequency, analytical parameters, quality assurance/quality control and reporting procedures.

YAEC has prepared a separate plan to outline groundwater monitoring that will be conducted to satisfy Nuclear Regulatory Commission (NRC) requirements. A copy of the *Groundwater Compliance Plan For License Termination Plan For The Yankee Nuclear Power Station* (GMP-LTP) is provided in Appendix A. In addition, monitoring of the former Southeast Construction Fill Area will be conducted to address the requirements of the Massachusetts Solid Waste Regulations, but is not addressed in this GMP-MCP.

2.0 *SUMMARY OF GROUNDWATER MONITORING AT YNPS*

2.1 *HISTORY OF GROUNDWATER WELL MONITORING AT YNPS*

Groundwater investigations began at YNPS in 1977 with the installation of the first monitoring well. Since 1977, a total of 78 monitoring wells have been installed. While 25 of these have been abandoned during site decommissioning, the remaining 53 support ongoing monitoring of site groundwater quality. A brief summary of primary well installation/abandonment events is provided below:

- Prior to 2003, 34 monitoring wells were installed at various times to investigate the shallow stratified drift aquifer.
- In 2003 and 2004, a comprehensive subsurface investigation program was initiated to evaluate groundwater quality deeper in the overburden beneath the shallow stratified drift deposits and into the underlying bedrock aquifer. This program included collection of continuous soil and rock cores and installation of 27 wells as a single, couplet or triplet monitoring point, including:
    - Four wells in the shallow stratified drift;
    - 13 wells in sand lenses interlayed within a lodgment till overlying the bedrock; and
    - 10 wells into the bedrock.
- In 2006, an additional 17 wells were installed to further define the extent of groundwater impact detected in previous events. This investigation focused on further characterization of groundwater quality in and around the Ion Exchange (IX) Pit and the Spent Fuel Pool (SFP) as the most significant suspected source of tritium in groundwater and the down-gradient extent of impact, including:
    - Nine wells in three well clusters to investigate the IX Pit (MW-110A, B, C, D), the SFP (MW-111A, B, C), and the Septic System Leachfield (MW-113A, B);

- Five shallow wells to bound the highest shallow tritium groundwater concentration (MW-101A, -102D, -104A, -107A, -109A);
- Two wells to investigate the highest deep tritium groundwater concentration (MW-107E, F); and
- One shallow well to investigate potential non-radiological impact down-gradient of the former Service Building (MW-105A).

Plant decommissioning activities necessitated the closure/abandonment of a total of 25 monitoring wells. These were generally older, shallow wells that were either damaged and of questionable integrity, duplicative of the current monitoring well network, or not worth maintaining during site re-grading, including:

- In July 2004, the following six wells were closed: B-1, CB-10, CB-11A, CW-11, CW-8, and MW-1.
- In November 2004, the following 16 wells were closed: CB-1, CB-12, CB-5, CB-7, CB-9, CFW-2, CFW-3, CFW-4, CFW-7, CW-3, CW-4, CW-5, MW-2, MW-5, MW-6, and OSR-1.
- In August 2005, the following three wells were closed: CB-2, CW-6, and CW-7.

Specifications for the remaining 53 monitoring wells are provided in Table 1. Well locations are displayed in Figure 2.

Additional wells are currently being installed which include two historic monitoring locations that were previously closed (CW-5 and MW-6) and two new monitoring locations (MW-112A and MW-104D) (Figure 2).

Since 2003, 12 comprehensive groundwater sampling events have been completed including analyses for both radiological and non-radiological contaminants. Characterization of groundwater quality for radiological contaminants is summarized in Table 3-4 of Appendix A. Characterization of groundwater for Oil and/or Hazardous Materials (OHM) included the following:

- Gasoline Range Organics (GRO) by GC, SW-846 Method 8015B;
- Diesel Range Organics (DRO) by GC, SW-846 Method 8015B;

- Extractable Petroleum Hydrocarbons (EPH), Volatile Petroleum Hydrocarbons (VPH), and target analytes by MADEP Methods MADEP-EPH-98-1 and MADEP-VPH-98-1;
- Semi-Volatile Organic Compounds (SVOCs) by GC/MS, SW-846 Method 8270C SVOCs, SIM analysis;
- Volatile Organic Compounds (VOCs) by GC/MS, SW-846 Method 8260B;
- Polychlorinated Biphenyls (PCBs) total and dissolved by GC, SW-846 Method 8082;
- Herbicides by GC, SW-846 Method 8151;
- Alcohols by FID Method ASTM D3695; and
- Priority Pollutant Metals (PP13), boron, and lithium by SW-846 Method 6010B.

2.2 *SUMMARY OF SITE GEOLOGY & HYDROGEOLOGY*

Results of subsurface investigations have resulted in the development of a Site Conceptual Model (SCM) that summarizes the site geology and hydrogeology. The SCM is described in detail in the GMP-LTP (Appendix A). The SCM describes the site as being comprised of the following four hydrogeologic units:

- Stratified Drift- a relatively permeable sand ranging in thickness from zero to 40 feet that contains the water table at depths ranging from 4 to 20 feet below ground surface in the central portion of the site.
- Glacial Till- a relatively impermeable mix of sand, silt and clay that is very dense and compact underlying the stratified drift. Till has been encountered from zero to 210 feet below ground surface across the site. Groundwater within this unit is confined/semi-confined to silty sand lenses that are up to a few feet in thickness and laterally discontinuous.
- Lake Deposits- an alternating sequence of fine silt and clay that is laminated (glaciolacustrine deposits) underlying the till at a depth

of 100 feet below ground surface in the northern portion of the site.

- Bedrock- an albite gneiss encountered at depths ranging from zero to 210 feet below ground surface. The upper surface of the bedrock appears to be moderately fractured and capable of yielding a few gallons per minute.

The rate and direction of groundwater flow beneath the site varies depending on location and hydrogeologic unit, but is generally northwest to west toward the Deerfield River. The rate of flow is greatest in the shallow stratified drift. Groundwater flow in the underlying till, lake deposits and bedrock is subject to both confined and semi-confined flow conditions due to the dense and laterally heterogeneous nature of these units. Flow in these units is estimated to be substantially slower than the stratified drift, but is generally toward the Deerfield River. The Deerfield River is estimated to represent the western, down-gradient extent of groundwater flow, which eventually discharges to river surface water.

2.3 *SUMMARY OF NATURE, EXTENT, TRANSPORT & FATE OF GROUNDWATER IMPACTS*

2.3.1 *Nature & Extent of Groundwater Impact*

Tritium

A detailed review of site groundwater monitoring for radioactive contaminants is included in Appendix A. Results indicate that the only radiological contaminant of concern in groundwater is tritium. The primary source of tritium release appears to have been leakage of cooling water contained in the SFP/IX Pit, which was recently excavated and removed (2005/2006).

A tritium plume has been identified in the shallow stratified drift originating from beneath the former footprint of the plant and extending northwest/west toward the Deerfield River. The highest concentrations of tritium detected in this shallow plume are 16,900 pCi/L (based on April 2006 result at MW-101A) at the plant and decreasing to 7,620 pCi/L (at MW-106A in July 2006) near the Deerfield River. Tritium levels in this plume have been below the Environmental Protection Agency (EPA) Maximum Contaminant Level (MCL) for drinking water of 20,000 pCi/L.

Tritium has been confirmed at a concentration above the EPA MCL in only one monitoring well, MW-107C, located within a sand lens in the till just below the outwash. The highest level of tritium detected at MW-107C was 48,000 pCi/L in September 2003. The level of tritium in MW-107C has decreased to 36,600 pCi/L (July 2006). Detected impacts at all other wells remain below the EPA MCL.

The distribution of tritium in the shallow stratified drift is consistent with the advective flow of groundwater down-gradient to the northwest/west of the plant. Concentrations tend to decrease down-gradient due to dilution and dispersion with increasing distance from the plant. Tritium in the underlying till is limited to confined/semi-confined sand lenses that appear to be laterally discontinuous, thereby limiting down-gradient transport, dilution or dispersion and resulting in the tritium level remaining above the EPA MCL at one monitoring point (MW-107C).

OHM

Results of monitoring for OHM were compared to the Massachusetts Contingency Plan (MCP) Reportable Concentrations for Groundwater Category GW-1 (RCGW-1). Table 2 summarizes wells where target OHM were detected above RCGW-1. Results indicate sporadic detections of OHM above RCGW-1 Standards that were generally not repeatable, not associated with a potential site release condition, or were found to be associated to well integrity issues (e.g., polychlorinated biphenyls (PCBs) in groundwater within damaged wells where PCB-containing paint chips infiltrated with storm water, or volatile organic compounds (VOCs) found in wells where glue containing the same VOCs had been used to attach temporary risers pipes during re-grading).

At least one additional round of monitoring will be conducted to confirm site groundwater quality results for OHM prior to site closure. Locations confirming OHM below RCGW-1 would be excluded from further monitoring, while any above would continue to be monitored until at least two consecutive rounds demonstrate OHM below RCGW-1 Standards.

2.3.2 *Transport & Fate of Groundwater Impact*

Tritium is the primary contaminant of concern (COC) in site groundwater. All liquid sources of tritium release have been removed. A tritium plume exists in the relatively permeable upper stratified drift and flows to the west discharging to the Deerfield River. The highest concentrations of tritium in the shallow plume are below the EPA MCL. These levels are expected to continue to decrease via dilution, dispersion and radioactive decay (tritium half-life is approximately 12 years).

Tritium has been detected in the deeper confined/semi-confined sand lenses within the underlying till. Tritium concentrations in this unit have been found to exceed the EPA MCL at only one monitoring point (MW-107C). The laterally discontinuous, disconnected nature of these lenses within very tight till limits dilution or dispersion resulting in minimal dilution of tritium over time. While groundwater within these lenses may slowly migrate to surface water, it is likely that dilution, dispersion and radioactive decay of tritium will reduce the concentrations to negligible levels prior to discharge to surface water.

Groundwater down-gradient of MW-107C is not currently, and in the future is unlikely to be, used as a source of drinking water. Nevertheless, groundwater monitoring will be conducted in accordance with the GMP-LTP and the GMP-MCP to establish that tritium concentrations continue to decrease as expected below the EPA MCL.

3.0 *GROUNDWATER REGULATORY REQUIREMENTS & PROPOSED COMPLIANCE PLAN*

3.1 *NUCLEAR REGULATORY COMMISSION REQUIREMENTS & COMPLIANCE PLAN*

Nuclear Regulatory Commission (NRC) site closure requirements for groundwater are stipulated in the YNPS License Termination Plan (LTP), NRC License Amendment No. 158. The GMP-LTP identifies the following criteria that must be met to satisfy LTP License Amendment No. 158:

- Demonstration that site-generated radionuclides, with the exception of tritium, are not present in groundwater above the limits presented in LTP License Amendment No. 158.
- An evaluation to demonstrate that maximum concentration of tritium in a well capable of supplying a resident farmer does not exceed 20,000 pCi/L.
- An evaluation to demonstrate that tritium concentrations in down-gradient off-site wells are less than 20,000 pCi/L.

Compliance with these criteria will be based on five rounds of quarterly monitoring conducted beginning in the Spring of 2006 and ending in the Spring of 2007.

3.2 *MASSACHUSETTS REQUIREMENTS & COMPLIANCE PLAN*

Under the Massachusetts Contingency Plan (MCP) 310 CMR 40.0000 site closure must meet the performance standards of a Permanent Solution for a Class A Response Action Outcome (RAO) Statement, or a Temporary Solution for a Class C RAO, until a Permanent Solution is achieved. Performance standards for achievement of a Permanent Solution include:

- Demonstration that residual concentrations of OHM (including tritium) do not pose a condition of "significant risk." Using quantitative risk estimation protocols the MCP carcinogenic risk-based threshold is a risk of 1×10^{-5}. For tritium, if no other significant risk contributors exist, the risk threshold corresponds to an estimated concentration of 23,000 pCi/L using standard DEP default exposure assumptions (Appendix B).

- Demonstration that residual concentrations of OHM (including tritium) do not pose a condition of "significant risk" by complying with applicable or suitably analogous regulatory standards. For tritium this includes the EPA MCL of 20,000 pCi/L, which is adopted by Massachusetts under 310 CMR 22.09A.

YAEC anticipates that in 2007 a Permanent Solution as a Class A RAO-Partial (RAO-P) will be filed for the majority of the site that does not pose a "significant risk." YAEC anticipates that this will include areas where soil could pose a "significant risk", but where a deed restriction and/or Activity and Use Limitation (AUL) will be filed to prevent activities and uses that could result in adverse exposure. Therefore, YAEC anticipates that the majority of the site would be eligible for a Class A-3 RAO-P.

However, the presence of tritium, and/or other OHM in site groundwater, at concentrations exceeding an applicable or suitably analogous regulatory standard constitutes, by definition under the MCP, a condition of "significant risk" that prevents filing a Permanent Solution as a Class A RAO-P in those portions of the site. At this time, YAEC anticipates that the only groundwater condition remaining at the site that will meet the definition of a condition of "significant risk" will be the presence of tritium in groundwater at monitoring well MW-107C. If so, the Class A-3 RAO-P would exclude the area surrounding MW-107C where groundwater has the potential to exceed the drinking water standard. YAEC anticipates that the portion of the site to be excluded from the Permanent Solution would be eligible for a Temporary Solution as a Class C RAO-P, or transitioned into a Remedy Operation Status (ROS) in support of a Monitored Natural Attenuation (MNA) remedy for groundwater (described below). The exact boundaries of the RAO-P will be determined after additional groundwater monitoring is conducted and the cumulative risk assessment is completed.

YAEC intends to utilize MNA to address the residual tritium impacts in groundwater. Active abatement via groundwater pump and treat does not appear to be a viable option since:

1. Pumping extensive volumes of groundwater from the construction excavations during source removal had no significant effect on the levels of tritium in MW-107C. The groundwater was discharged to surface water under a National Pollution Discharge Elimination System permit for

construction dewatering. Hydraulic pump testing of MW-107C also resulted in minimal yield and no reduction in tritium concentrations. These results suggest that recovery via pumping is not feasible due to the very low yield of the sand lens in which this well screen is completed.

2. There is no available treatment technology for tritium in groundwater, either on or off-site. MA DEP has stated that discharge to surface water without treatment, as was done during the excavation activities, would not be an acceptable remedial alternative for the site.

3. Off-site disposal of large volumes of water would not be feasible from a risk-reduction/cost-benefit standpoint in considering that this would generate a costly waste stream and increase short-term risk.

There are two MCP regulatory filing options for addressing the portion of the site that will not be the subject of the Permanent Solution, including: 1) a Temporary Solution as a Class C-2 RAO-P; or 2) to file a ROS for MNA for groundwater. The bases for these alternatives are:

1. The infeasibility (considering risk reduction and cost-benefit) of abatement to achieve a Permanent Solution.

2. Site conditions would meet risk-based performance standards for a Temporary Solution including elimination of a "substantial hazard" (no risk in the short-term/several years, because there is no current exposure pathway as no one is drinking the water, but potential for long-term risk based on tritium remaining above an MCL and the potential for groundwater to be used as a future source of drinking water, since there are no alternate potable public water supplies in the vicinity of the site).

3. MNA is anticipated to result in the achievement of a Permanent Solution for the site.

Under a Class C-2 RAO-P or ROS, groundwater monitoring would continue for a period of five to ten years at which point natural attenuation and radioactive decay of tritium is anticipated to reduce the levels below the MCL. YAEC anticipates that a decision regarding a Class C-2 RAO-P or ROS filing will be reached following evaluation of groundwater monitoring results for the Spring 2007 event (completion of monitoring to support NRC requirements). Once it was demonstrated through additional groundwater monitoring that the levels of tritium are permanently reduced below the MCL, a Permanent Solution (Class A-3 RAO) will be filed for the remainder of the site and groundwater monitoring will be terminated.

4.0 YAEC'S PROPOSED GROUNDWATER MONITORING PLAN

4.1 RADIOLOGICAL GROUNDWATER MONITORING PLAN

Appendix A includes the GMP-LTP. This report includes the radiological groundwater monitoring plan that will be conducted in accordance with the License Termination Plan (LTP) and Nuclear Regulatory Commission (NRC) License Amendment No. 158. Quarterly groundwater sampling (with additional sampling for tritium at select wells) was proposed to begin in Spring 2006 and conclude no earlier than Spring 2007. Radiological sample parameter lists and QA/QC requirement are discussed in Appendix A.

To satisfy MCP requirements, at least annual monitoring for tritium will be conducted at selected well locations based on the following rationale:

1. MW-107C due to levels in excess of the MCL.
2. Additional wells where tritium had been detected at levels exceeding 25% of the MCL or greater than 5,000 pCi/L, including. The following wells meet this criterion based on a preliminary review of the data:

    - MW-107A, MW-107D, MW-107E, MW-107F
    - MW-101A
    - MW-102D
    - MW-106A (a down-gradient well)
    - MW-111C

Monitoring is expected to continue at least annually until the levels of tritium in MW-107C naturally decay permanently below the MCL. Once monitoring results indicate levels have decayed below the MCL, a permanent reduction in the levels of tritium in MW-107C will be established based on generating four consecutive quarterly monitoring rounds over a one-year period indicating tritium at levels below the MCL of 20,000 pCi/L.

Monitoring of tritium levels at each of the additional wells will continue until either: 1) titium concentrations from two consecutive sampling events are below 25% of the MCL or 5,000 pCi/L); or 2) tritium concentrations in MW-107C are consistently below the MCL (based on results from four consecutive quarterly monitoring events). In this manner the monitoring program can be pared down to focus efforts on those locations necessary to confirm compliance with MCP Response Action Performance Standards for a Permanent Solution. Groundwater monitoring will be terminated after achievement of a Permanent Solution as a Class A-3 RAO for the entire site.

The list of wells to be sampled for tritium will be re-evaluated based on the results of the quarterly sampling proposed in the GMP-LTP. Wells could be added to, or removed from, the above list of locations targeted for monitoring based on the criteria outlined above. In addition, a more frequent sampling program may be implemented if deemed appropriate to facilitate site closure using the above criteria (i.e., sampling rounds could be conducted annually, semi-annually or, at a minimum frequency, quarterly).

4.2 *OHM GROUNDWATER MONITORING PLAN*

Groundwater sampling and analysis of OHM parameters will be conducted in the Fall of 2006 at select monitoring well locations (Table 3 and Figure 2). The groundwater sampling event will focus on monitoring wells that have previously exceeded RCGW-1 Standards. Additionally, sampling will be conducted at replacement monitoring well locations that historically exceeded RCGW-1 Standards and were abandoned during decommissioning activities.

Analytical results from the Spring and Fall 2006 groundwater monitoring events will be evaluated to determine the need for future sampling. Groundwater monitoring will be conducted at select monitoring wells that continue to exceed RCGW-1 standards (or an alternative risk-based standard agreed to by YAEC and MA DEP). Monitoring will be conducted at least annually until the levels of OHM in groundwater are below RCGW-1 standards for two consecutive rounds at each individual well. As with the radiological sampling, a more frequent sampling program may be implemented if deemed appropriate to facilitate site closure using the above criteria (i.e., sampling could be conducted annually, semi-annually or quarterly).

Sampling proposed in Table 3 will be conducted in accordance with YAEC standard operating procedures and the *Quality Assurance Project Plan, Site Closure, Revision 2, Yankee Nuclear Power Station, Rowe, Massachusetts, Gradient, 20 December 2005*. The following Quality Assurance / Quality Control (QA/QC) samples will be collected during groundwater sampling activities for OHM parameters:

- Trip Blanks - One trip blank set for every 20 VOC, Alcohol or VPH samples or one trip blank set in every cooler used to ship VOC, Alcohol or VPH samples, whichever number is greater. Each VOA vial trip blank is filled with an aliquot of deionized water and sealed with Teflon septa. The trip blanks should be prepared and provided by the analytical laboratory.
- Temperature Blanks - One temperature blank per cooler. The temperature of the temperature blank will be measured upon receipt of the cooler at the laboratory.
- Equipment Rinsate Blank - The majority of groundwater samples will be collected using dedicated sampling equipment. However, where the depth to water is greater than 30 feet, a submersible pump will be used. A rinsate sample will be collected from the pump at a rate of one sample per 20 sampling locations. The rinsate blanks will be analyzed for the same parameters as the samples that were collected using the equipment.
- Field Duplicates - Field duplicates will be collected at the rate of one duplicate per 20 samples. Field duplicates will be submitted for the same analyses as the parent sample. Field duplicates should be submitted "blind" to the analytical laboratory.
- Matrix Spikes - Matrix spikes will be collected at the rate of one matrix spike and one matrix spike duplicate per 20 samples. Matrix spikes/matrix spikes duplicates will be analyzed for the same analyses as the actual sample. The monitoring well location for matrix spikes and matrix spike duplicates are identified to the analytical laboratory.

4.3 *WELL CLOSURES*

Monitoring wells that will not be included in the GMP-LTP or GMP-MCP will be decommissioned in-place within one year of termination of monitoring at each location.

Tables

Table 1
Summary of Monitoring Well Specifications
Yankee Nuclear Power Station
Rowe, MA

Monitoring Well ID	Date Completed	Well Location	Total Depth Drilled (feet)	Well Screen Length (feet)	Well Screen Interval (ft bg)	Geologic Unit at Screen Interval	Screen Sand Pack Interval (ft bg)	Diameter of Sand Pack (inches)	Bentonite Seal Interval (ft bg)	Cement Grout Seal Interval (ft bg)	Well Inside Diameter (in.)	Well Wall (PVC)	Well Screen Slot Size (in.)	8-Inch Steel Casing Interval (ft bg)
CB-3	29-Apr-93	Northeast of former Fire Tank	15	10	3 to 10	Stratified Drift	3 to 15	5.000	2 to 3	0 to 2	2.25	Schd 40	I/U	N/A
CB-4	5-May-93	Old septic leaching field	19	10	9 to 19	Stratified Drift	8 to 20	5.000	7 to 8	0 to 7	2.25	Schd 40	I/U	N/A
CB-6	13-Sep-94	Sherman dam embankment, south side; Sherman Spring area	25	10	15 to 25	Stratified Drift	14 to 26	5.000	12 to 14	0 to 12	2.25	Schd 40	I/U	N/A
CB-8	20-Sep-94	North of old PCA in outdoor rad storage area.	19	5	14 to 19	Till	13 to 19	5.000	11.5 to 13	0 to 11.5	2.25	Schd 40	I/U	N/A
CW-2	29-Apr-93	West of Safety Injection Tanks (RCA)	20	10	9 to 19	Stratified Drift	9 to 20	5.000	8 to 9	0 to 8	2.25	Schd 40	I/U	N/A
CW-10	8-Jun-98	North of Stores warehouse	30	15	15 to 30	Bedrock	14 to 30.5	4.000	13 to 14	0 to 13	2.00	Schd 40	0.010	N/A
CFW-1	13-Dec-99	Southeast construction fill area margin	8	5	3 to 8	Stratified Drift	2 to 8	4	1 to 2	0 to 1	2.00	Schd 40	0.010	N/A
CFW-5	14-Dec-99	Southeast construction fill area margin	5	5	1 to 5	Stratified Drift	0.5 to 5	5	0 to 0.5	1 to 0	2.00	Schd 40	0.010	N/A
CFW-6	14-Dec-99	Southeast construction fill area margin	6	5	1 to 6	Stratified Drift	0.5 to 6	5	0 to 0.5	0.5 to 0	2.00	Schd 40	0.010	N/A
MW-100A	5-Aug-03	Northern area of RCA	20	10	10 to 20	Stratified Drift	8.3 to 20	5.5	6.0 to 8.3	0 to 6.0	2.0	Schd 40	0.010	N/A
MW-100B	4-Aug-03	Northern area of RCA	43	10	32.9 to 42.9	Bedrock	31.0 to 43	4.625	28.0 to 31.0	0 to 28.0	2.0	Schd 40	0.010	N/A
MW-101A	11-Apr-06	South side of VC	23.5	5	18 to 23	Fill	16 to 23.5	5.5	13 to 16	0 to 13	2.0	Schd 40	0.010	0 to 10*
MW-101B	13-Aug-03	South side of VC	156	10	142 to 152	Bedrock	140.2 to 156	4.625	138.5 to 140.2	0 to 138.5	2.25	Schd 80	0.010	0 to 11.25
MW-101C	15-Aug-03	South side of VC	99	5	94 to 99	Sand and Silt	92.1 to 99	5.5	90.0 to 92.1	0 to 90.0	2.0	Schd 40	0.010	0 to 15.3
MW-102A	31-Jul-03	North Side of VC	39	5	33 to 38	Sand and Silt	31.0 to 39	5.5	29.0 to 31.0	0 to 29.0	2.0	Schd 40	0.010	N/A
MW-102B	24-Jul-03	North Side of VC	131.5	10	120.2 to 130.2	Bedrock	117.9 to 131.5	4.625	116.0 to 117.9	0 to 116.0	2.0	Schd 40	0.010	0 to 15
MW-102C	29-Jul-03	North Side of VC	99	5	94 to 99	Sand & Gravel	92.4 to 99	5.5	90.8 to 92.4	0 to 90.8	2.0	Schd 40	0.010	0 to 14.5
MW-102D	10-Feb-06	North Side of VC	22	10	11 to 21	Sand & Gravel	9 to 22	5.5	7 to 9	0 to 7	2.0	Schd 40	0.010	0 to 8
MW-103A	17-Jul-03	Northwest side of Security Center	26	10	15 to 25	Stratified Drift	13 to 26	5.5	11 to 13	0 to 11	2.0	Schd 40	0.010	N/A
MW-103B	10-Jul-03	Northwest side of Security Center	295	10	284.5 to 294.5	Bedrock	282 to 295	4.625	279 to 282	0 to 279	2.25	Schd 80	0.010	0 to 30
MW-103C	16-Jul-03	Northwest side of Security Center	125	10	115 to 125	Laminated Clay & Sand	112.3 to 125	5.5	110.5 to 112.3	0 to 110.5	2.0	Schd 40	0.010	N/A
MW-104A	6-Feb-06	Downgradient mid-plume location	27	10	10 to 20	Sand & Gravel	8 to 20	5.5	6 to 8	0 to 6	2.0	Schd 40	0.010	0 to 10
MW-104B	3-Sep-03	Downgradient mid-plume location	194.5	10	184 to 194	Bedrock	182 to 194.5	5.5: 182' to 187' 4.625: 187' to 194.5'	180 to 182	0 to 180	2.25	Schd 80	0.010	0 to 25
MW-104C	11-Sep-03	Downgradient mid-plume location	99	10	87 to 97	Laminated Silt & Sand	84.8 to 99	7.625	82.8 to 84.8	0 to 82.8	2.25	Schd 80	0.010	N/A
MW-105A	8-Feb-06	North of Service Building	25	10	10 to 20	Sand & Gravel	8 to 20	5.5	6 to 8	0 to 6	2.0	Schd 40	0.010	0 to 8
MW-105B	20-Aug-03	North of Service Building	75	10	64 to 74	Bedrock	61.8 to 75	4.625	59.6 to 61.8	0 to 59.6	2.0	Schd 40	0.010	0 to 25
MW-105C	21-Aug-03	North of Service Building	45	10	27 to 37	Silt and Sand	25.1 to 37	5.5	23.1 to 25.1	0 to 23.1	2.0	Schd 40	0.010	N/A
MW-106A	30-Aug-04	Downgradient portion of site near to Deerfield River	22	10	12 to 22	Sand & Gravel	9.5 to 22	7.625	7.5 to 9.5	0 to 7.5	2.0	Schd 40	0.010	N/A
MW-106B	27-Aug-04	Downgradient portion of site near to Deerfield River	265	10	251 to 261	Bedrock	249 to 265	4.625	230 to 249	0 to 230	2.25	Schd 80	0.010	N/A
MW-106C	8-Sep-04	Downgradient portion of site near to Deerfield River	95	5	90 to 95	Sand and Silt	86.5 to 95	5.5	80 to 86.5	0 to 80	2.0	Schd 40	0.010	0 to 25
MW-106D	14-Sep-04	Downgradient portion of site near to Deerfield River	155	10	144 to 154	Sand and Silt	142 to 154	5.5	132 to 142	0 to 132	2.25	Schd 80	0.010	0 to 25

Table 1
Summary of Monitoring Well Specifications
Yankee Nuclear Power Station
Rowe, MA

Monitoring Well ID	Date Completed	Well Location	Total Depth Drilled (feet)	Well Screen Length (feet)	Well Screen Interval (ft bg)	Geologic Unit at Screen Interval	Screen Sand Pack Interval (ft bg)	Diameter of Sand Pack (inches)	Bentonite Seal Interval (ft bg)	Cement Grout Seal Interval (ft bg)	Well Inside Diameter (in.)	Well Wall (PVC)	Well Screen Slot Size (in.)	8-Inch Steel Casing Interval (ft bg)
MW-107A	5-Apr-06	NE side of VC and NW of spent fuel pool	30	5	21 to 26	Sand & Gravel	19 to 26	5.5	16 to 19	0 to 16	2.00	Schd 40	0.010	0 to 9
MW-107B	17-Sep-03	NE side of VC and NW of spent fuel pool	110	10	99.7 to 109.7	Bedrock	97.8 to 109.7	4.625	96.0 to 97.8	0 to 96.0	2.25	Schd 80	0.010	0 to 12.5
MW-107C	19-Sep-03	NE side of VC and NW of spent fuel pool	32	5	27 to 32	Sand and Silt	25 to 32	5.5	23 to 25	0 to 23	2.0	Schd 40	0.010	N/A
MW-107D	24-Sep-03	NE side of VC and NW of spent fuel pool	81.2	5	75 to 80	Sand and Silt	73 to 81.2	5.5	71.1 to 73	0 to 71.1	2.0	Schd 40	0.010	N/A
MW-107E	15-May-06	NE side of VC and NW of spent fuel pool	70	5	52 to 57	Sand Lens in Till	50 to 59	5.5	46-50	0 to 46	2.0	Schd 40	0.010	0 to 32
MW-107F	23-May-06	NE side of VC and NW of spent fuel pool	57	5	49 to 54	Sand Lens in Till	47 to 55	5.5	40.5 to 47	0 to 40.5	2.0	Schd 40	0.010	0 to 25
MW-108A	17-Jul-04	Peninsula near Sherman Reservoir	25	10	14.7 to 24.7	Sand and Silt	10 to 25	5.5	6.1 to 10	0 to 6.1	2.0	Schd 40	0.010	N/A
MW-108B	16-Jul-04	Peninsula near Sherman Reservoir	215	10	205 to 215	Bedrock	202.5 to 215	5.5	197.5 to 202.5	0 to 197.5	2.25	Schd 80	0.010	0 to 26
MW-108C	8-Jul-04	Peninsula near Sherman Reservoir	170	5	60 to 65	Silty fine Sand	57 to 67	7.625	51-57&67-170	0 to 51	2.0	Schd 40	0.010	0 to 26
MW-109A	3-Feb-06	West side of Industrial Area	20	10	10 to 20	Sand & Gravel	8 to 20	5.5	4 to 8	0 to 4	2.0	Schd 40	0.010	0 to 8
MW-109B	2-Aug-04	West side of Industrial Area	190	10	180 to 190	Bedrock	177.5 to 190	4.625	175.5 to 177.5	0 to 175.5	2.25	Schd 80	0.010	0 to 20
MW-109C	9-Aug-04	West side of Industrial Area	55	5	49 to 54	Sand with Silt	46.8 to 55	5.5	42.5 to 46.8	0 to 42.5	2.0	Schd 40	0.010	N/A
MW-109D	6-Aug-04	West side of Industrial Area	113	5	88.7 to 93.7	Sand & Gravel	86 to 95	5.5	83-86&95-113	0 to 83	2.0	Schd 40	0.010	0 to 21
MW-110A	16-Feb-06	Adjacent to area of release associated with Ion exchange pit	31	5	25 to 30	Sand & Gravel	22 to 31	5.5	17 to 22	0 to 17	2.0	Schd 40	0.010	0 to 10
MW-110B	6-Mar-06	Adjacent to area of release associated with Ion exchange pit	110	10	100 to 110	Bedrock	98 to 110	4.625	93 to 98	0 to 93	2.0	Schd 40	0.010	0 to 38
MW-110C	20-Mar-06	Adjacent to area of release associated with Ion exchange pit	51	5	46 to 51	Sand Lens in Till	44 to 51	5.5	38 to 44	0 to 38	2.0	Schd 40	0.010	0 to 38
MW-110D	17-Mar-06	Adjacent to area of release associated with Ion exchange pit	88	5	83 to 88	Sand Lens in Till	81 to 88	5.5	75 to 81	0 to 75	2.0	Schd 40	0.010	0 to 33
MW-111A	30-Mar-06	Northeast side of SFP, downgradient of fuel transfer shute	23	5	18 to 23	Sand & Gravel	15.5 to 23	7.625	12 to 15.5	0 to 12	2.0	Schd 40	0.010	0 to 8
MW-111B	28-Mar-06	Northeast side of SFP, downgradient of fuel transfer shute	80	10	70 to 80	Bedrock	67 to 80	4.625	62 to 67	0 to 62	2.0	Schd 40	0.010	0 to 30
MW-111C	31-Mar-06	Northeast side of SFP, downgradient of fuel transfer shute	41	5	32 to 37	Sand Lens in Till	30 to 37	5.5	26 to 30	0 to 26	2.0	Schd 40	0.010	0 to 29
MW-113A	27-Apr-06	Northern portion of site adjacent to Deerfield River	25	10	15 to 25	Sand & Gravel	13 to 25	5.5	7.5 to13	0 to 7.5	2.0	Schd 40	0.010	0 to 8
MW-113C	26-Apr-06	Northern portion of site adjacent to Deerfield River	140	10	127 to 137	Sand and Silt	125 to 137	5.5	120 to 125	0 to 120	2.0	Schd 40	0.01	0 to 30

Notes:
Information from the "Groundwater Monitoring Plan to Support Yankee Nuclear Power Station License Termination Plan," dated June 2006, and ERM Reports
ft bg=feet below grade; N/A=not applicable; Schd=schedule; all wells completed with # 0 (medium) sand pack; SFP=Spent Fuel Pool
* = 6-inch diameter steel casing; I/U - Information Unavailable, TBC - To Be Constructed

Table 2
Summary of Contaminants in Groundwater
Yankee Nuclear Power Station
Rowe, MA

Monitoring Well ID	Historic Results Greater than RCGW-1	Elevated Tritium	MCP Groundwater Monitoring	Comment
CB-3	Antimony		No	Average of sample and duplicate below RCGW-1
CB-4	silver		No	Subsequent sampling below RCGW-1
CFW-3	antimony		No	Former SCFA monitoring addressed separately
CFW-7	bis(2-Ethylhexyl)phthalate		No	Former SCFA monitoring addressed separately
CW-5R	-		Yes	Replacement well to evaluate downgradient of former fuel oil tank
CW-10	bis(2-Ethylhexyl)phthalate		Yes	
MW-5	Polychlorinated Biphenyls		No	See MW-110A
MW-6R	Extractable Petroleum Hydrocarbons (C11-C22)		Yes	Replacement well to evaluate historic EPH concentrations
MW-101A	arsenic	X	Yes	
MW-101B	Extractable Petroleum Hydrocarbons (C11-C22)		Yes	
MW-101C	Volatile Petroleum Hydrocarbons (C5-C8), acetone		Yes	
MW-102C	lead		No	Subsequent sampling below RCGW-1
MW-102D	-	X	Yes	
MW-103B	lead, bis(2-Ethylhexyl)phthalate		No	Subsequent sampling below RCGW-1
MW-103C	acetone, arsenic, bis(2-Ethylhexyl)phthalate		No	Subsequent sampling below RCGW-1
MW-105B	bis(2-Ethylhexyl)phthalate		Yes	
MW-105C	1,1-Dichloroethylene, acetone		Yes	
MW-106A	-	X	Yes	
MW-107A	arsenic and silver	X	Yes	
MW-107B	Polychlorinated Biphenyls		Yes	
MW-107C	pentachlorophenol	X	Yes	Subsequent sampling below RCGW-1 for pentachlorophenol
MW-107D	Polychlorinated Biphenyls	X	Yes	
MW-107E	-	X	Yes	
MW-107F	-	X	Yes	Not yet sampled for OHM
MW-108B	bis(2-Ethylhexyl)phthalate, pentachlorophenol		No	Subsequent sampling below RCGW-1
MW-109B	pentachlorophenol		Yes	
MW-109C	pentachlorophenol		Yes	
MW-109D	pentachlorophenol		Yes	
MW-110A	-		Yes	Evaluate historic PCBs at MW-5
MW-110C	2-butanone (MEK)		Yes	
MW-111B	2-butanone (MEK)		Yes	
MW-111C	-	X	Yes	
MW-112A	-		Yes	New well downgradient of solvent usage area

Notes:
Non-Radiological Groundwater concentrations compared to Report Concentration (RCGW-1) standards
Elevated Tritium = Greater than 5,000 pCi/L based on a preliminary review of July 2006 data
- = sample results below RCGW-1 standards

Table 3
MCP Groundwater Monitoring Parameters
Yankee Nuclear Power Station
Rowe, MA

Well Designation	Sample ID	Status	Analytical Parameters							
				OHM						
			Tritium	VOC	SVOC	ALCOHOL	EPH	VPH	PP13 Metals plus Boron	Total PCBs
CW-5R	CW-5R	Proposed Replacement Well		X			X	X		
CW-10	CW-10	Existing			X					
MW-6R	MW-6R	Proposed Replacement Well		X			X			
MW-101A	MW-101A	Existing	X						X	
MW-101B	MW-101B	Existing					X			
MW-101C	MW-101C	Existing		X		X		X		
MW-102D	MW-102D	Existing	X							
MW-105B	MW-105B	Existing			X					
MW-105C	MW-105C	Existing		X				X		
MW-106A	MW-106A	Existing	X							
MW-107A	MW-107A	Existing	X						X	
MW-107B	MW-107B	Existing								X
MW-107C	MW-107C	Existing	X							
MW-107D	MW-107D	Existing	X							X
MW-107E	MW-107E	Existing	X							
MW-107F	MW-107F	Existing	X	X					X	
MW-109B	MW-109B	Existing			X					
MW-109C	MW-109C	Existing			X					
MW-109D	MW-109D	Existing			X					
MW-110A	MW-110A	Existing								X
MW-110C	MW-110C	Existing		X						
MW-111B	MW-111B	Existing		X						
MW-111C	MW-111C	Existing	X							
MW-112A	MW-112A	Proposed New Well		X^1					X	
Total Original Samples:			**9**	**8**	**5**	**1**	**3**	**3**	**4**	**3**
Total Duplicate Samples:			**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

Notes:
X^1 To be analyzed with Tentatively Identified Compounds (TICs)

Figures

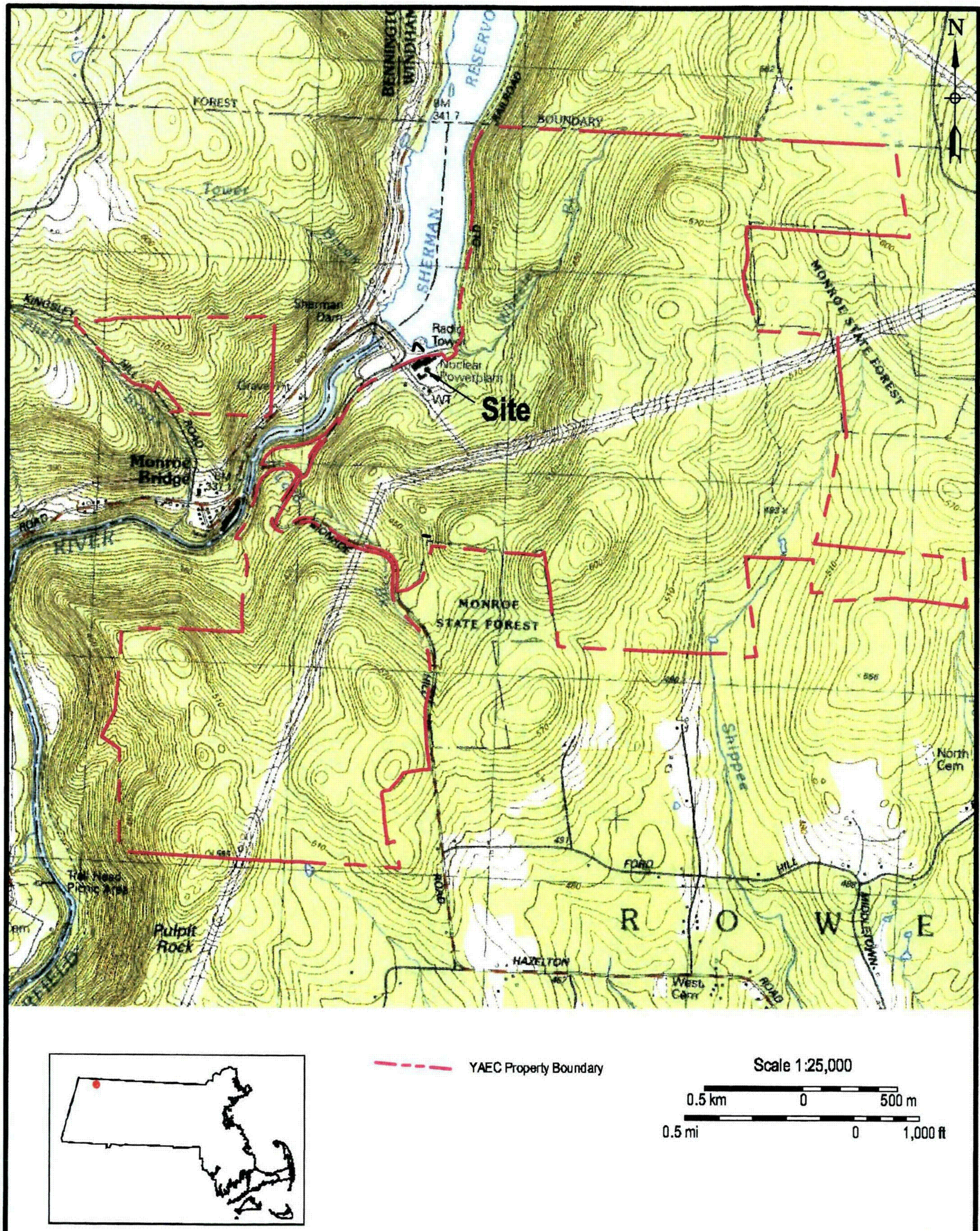

Figure 1 - Locus Map
Yankee Nuclear Power Station - Rowe, MA

ERM

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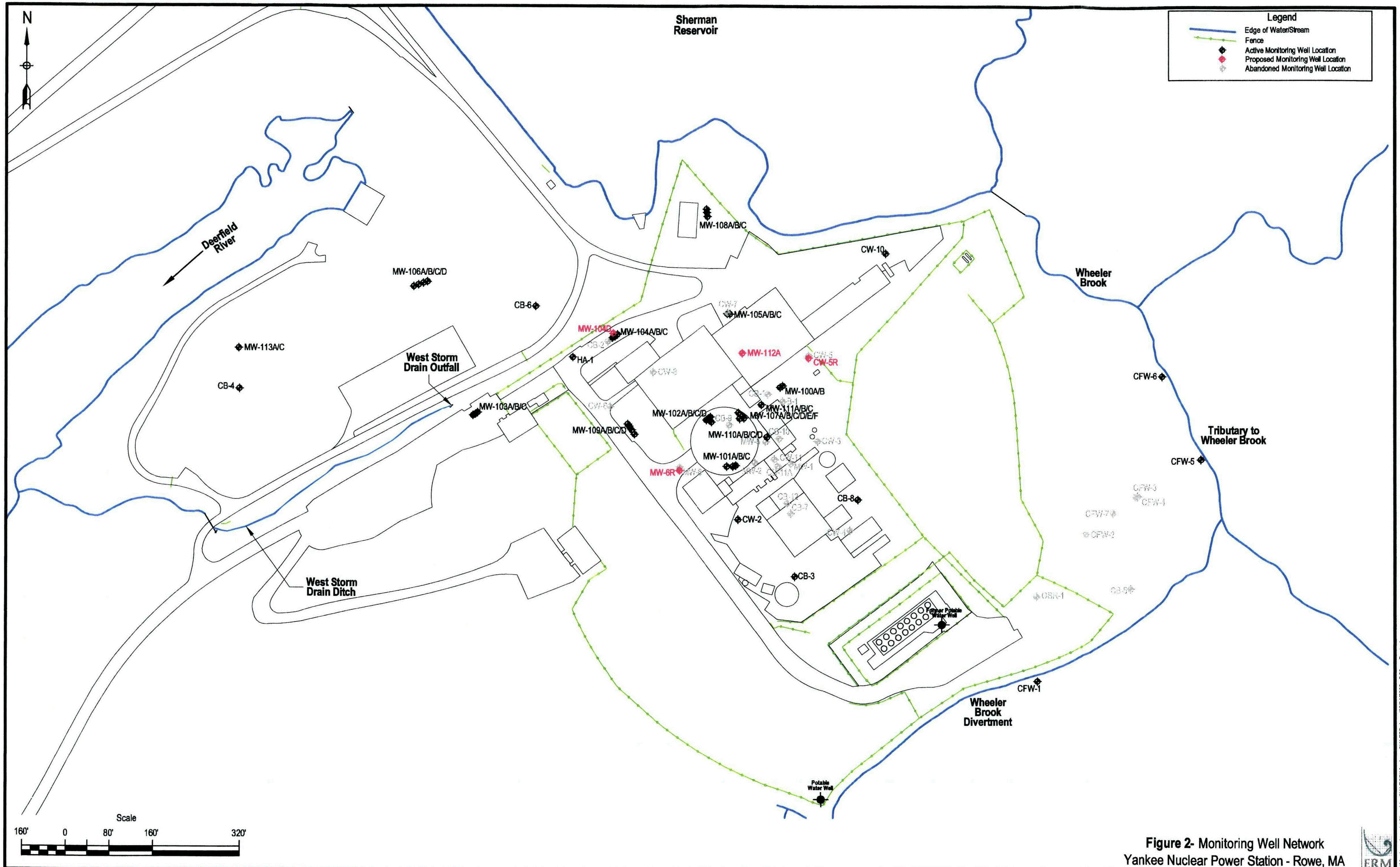

Figure 2- Monitoring Well Network
Yankee Nuclear Power Station - Rowe, MA

ERM

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Appendix B
Tritium Risk-Based Concentration in Drinking Water

Attachment B

Tritium Risk-Based Concentration in Drinking Water

The attached table presents that risk-based concentration (RBC) for tritium in drinking water. The calculation adopts Mass DEP default exposure assumptions for child and adult drinking water consumption over a total exposure duration of 30 years. The calculations adjust for inherent radioactive decay of tritium (half-life = 12 years). As shown in the table, a 10-5 RBC for drinking water is 23,060 pCi/L, which is consistent with the EPA and Mass DEP drinking water criteria of 20,000 pCi/L.

The average concentration over the child (0 - 6 years) and adult (6 - 24 years) was calculated following the methods in Section 4.2.2 of the January 2005 YAEC Human Health Risk Assessment Work Plan (Draft), excerpted below without modification for ease of reference.

January 2005 YAEC Human Health Risk Assessment Work Plan (Draft) - Excerpt

4.2.2 Exposure Quantification for Radionuclides

Potential exposure to radionuclides is calculated in terms of radioactivity (in pico-curies, or "pCi") rather than in chemical mass units. Exposures *via* ingestion and inhalation pathways are calculated using similar approaches to those just described for chemical exposure, simply expressing exposure as the total amount of radioactivity (pCi) received over a particular duration. In the equations below, the radiation exposure is expressed in terms of an "intake factor." The intake factor accounts for either ingestion (*e.g.*, soil, water, food) or inhalation. Radiation intake for these pathways is given by (USEPA, 2000):[1]

$$IF = EPC \times IR \times EF \times ED \quad (4\text{-}4)$$

where:

IF	=	Intake factor (pCi)
EPC	=	Exposure point concentration (*e.g.*, pCi/g, pCi/m^3, pCi/L)
IR	=	Media intake rate (*e.g.*, g/day, m^3/day, L/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)

As can be seen by comparing Equation (4-1) and (4-4), the intake factor for radionuclides is a function of exposure duration and exposure frequency. The media intake rates, exposure frequency and duration for radionuclide intake are identical to those for the chemical exposure estimates, and are provided in Table 2.

The concentration of radionuclides in the environment declines according to radionuclide-specific decay rates. Thus, the EPC is not a constant, but rather declines as a function of time according to the following exponential equation:

$$EPC(t) = EPC_o\, e^{-\lambda t} \quad (4\text{-}5)$$

where

EPC(t) = concentration as a function of time (pCi/g)

[1] The equations presented by USEPA (2000) are for a "risk-based" concentration in soil, air, water, *etc.* The intake is given by simply rearranging those equations such that they are expressed as a "risk equation" without substituting a "target risk" value.

EPC_o	=	initial concentration at time t=0 (pCi/g)
λ	=	$\frac{\ln(2)}{t_{1/2}}$ is the decay constant (per year)
$t_{1/2}$	=	half-life (years)

The average concentration ($\overline{EPC}$) over a particular time period (T) is given by integrating the declining concentration over the time period:

$$\overline{EPC} = \frac{1}{T}\int_0^T EPC_o e^{-\lambda t} dt = EPC_0 \frac{(1-e^{-\lambda T})}{T\lambda} \quad (4\text{-}6)$$

In the above equation, the time period "T" is equivalent to the exposure duration (ED) in Equation (4-4). Thus, combining the expression for the average concentration for EPC in Equation (4-6) with the intake factor expression in Equation 4-4), gives the following decay-adjusted intake factor

$$IF = EPC_0 \frac{(1-e^{-\lambda T})}{\lambda} \times IR \times EF \quad (4\text{-}7)$$

where EPC_o is the exposure point concentration at the beginning (time t=0) of the exposure period.

Tritium Drinking Water Risk-Based Concentration Determination

Chemicals Evaluated	Concentration (C) (pCi/L)	Half-Life $t_{1/2}$ (yrs)	Cadj child (pCi/L)	Cadj adult (pCi/L)	Slope Factor (SF) (Risk/pCi)	DCF Ing (mrem/pCi)	Cancer Risk (Cadj×IF×SF)	Dose (mrem/yr)	RBC 1.00E-05	RBC (dose) 4
Tritium	**23,000**	12.0	19,437.6	8,798.7	5.07E-14	6.40E-08	9.97E-06	0.87	**23,060**	106,342
						Total	1.0E-05	0.9		

Intake Factor (IF) -- adult	IR x FS x EF x ED	=	**1.75E+04**	IF (dose) = IR x FS x EF =	**7.30E+02**
Intake Factor (IF) -- child	IR x FS x EF x ED	=	**2.19E+03**	IF (dose) = IR x FS x EF =	**3.65E+02**
	IR	Ingestion Rate--adult (L/day)	2		
	ED	Exposure Duration--adult (yr)	24		
	IR	Ingestion Rate -- child (L/day)	1		
	ED	Exposure Duration - child (yr)	6		
	EF	Exposure Frequency (d/yr)	365		
	FS	Fraction from Contaminated Source	1		

Notes:

Cadj is the decay-adjusted concentration over the exposure period based on the radionuclide decay half-life.

Slope Factor source: HEAST